BLM LIBRARY
88045364

Sohare Creek Unit
Exploratory Oil Well No. 1-35
DRAFT
Environmental Impact Statement

Proposed Oil and Gas Drilling
Near Jackson, Teton County, WY

Department of Interior
Bureau of Land Management
Rock Springs District

Department of Agriculture
Forest Service
Bridger-Teton National Forest

CONTRIBUTORS AND PRINCIPAL INVESTIGATORS

Bureau of Land Management

Rock Springs District:

Gary Bauer, Assistant District Manager, Mineral Resources
Bob Chase, Geologist, Fluid Minerals Branch Chief
Bill McMahan, Environmental Coordinator, Project Leader
Don Schramm, Assistant District Manager, Operations-Engineering
Al Stein, Assistant District Manager, Planning and Environmental
Angelina Prych, Writer/Editor

Wyoming State Office, Cheyenne:

Lynn Rust, Fluids Specialist, Minerals Staff
Ed McTaggart, Environmental Coordinator, Environmental Staff

U.S. Forest Service

Bridger-Teton National Forest:

Al Reuter, Minerals Specialist, Project Leader
Joe Kinsella, Jackson District Ranger
John Baglien, Buffalo District Ranger
Paul Arndt, Socioeconomics
Floyd Gordon, Wildlife Biologist, Wildlife/Fisheries
Dave Griffel, Wildlife Biologist, Wildlife/Fisheries
Doyle Conklin, Civil Engineer, Transportation/Engineering
Gary Jann, Landscape Architect, Visual/Recreation
Carl Pence, Land Use Planner
Gordon Warrington, Soils Specialist
Al Galbraith, Hydrologist
Gene Smalley, Range Conservationist
Elaine Mercill, Writer/Editor

U.S. Fish and Wildlife Service

Helena, Montana:

Wayne Brewster, Field Office Supervisor
Rob Hazelwood, Endangered Species

Consultant Preparation
Gary Holsan, Environmental Planning

Gary Holsan, Project Manager
Oliver John Grah, Assistant Project Manager, Water Resources/
Vegetation/Timber/Range/Air Quality
Robert Harrower, Transportation/Engineering/Health and Safety
Roni Slavin Pekins, Transportation/Wildlife
Nawzad Samarrae, Transporation/Cartography
William Glenn, Soils
Richard Valdez, Fisheries
Laurence Crist, Fisheries
Larry Hayden-Wing, Wildlife Biology
Roy Hugie, Wildlife/Range Resources
Richard Krannich, Sociology/Recreation
Steve Daniels, Economics
Craig Johnson, Visual Resources
Vern Budge, Visual Resources
John Senulis, Cultural Resources
Miriam Rand, Writer/Editor
Gerald Hughes, Cartography

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

ID 88045364

IN REPLY REFER TO: TD 195 .P4 S643 1987
1792 (934)
Sohare
W-60212

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ROCK SPRINGS DISTRICT OFFICE
P.O. Box 1869
Rock Springs, Wyoming 82902-1869
(307) 382-5350

Dear Reviewer:

This draft environmental impact statement (DEIS) on the proposed Sohare Creek exploratory oil well is provided for your review and comment. This DEIS assesses the impacts of the exploratory oil well proposal made by Amoco Production Company. It has been developed under joint lead by the USDA Forest Service (FS) and the USDI Bureau of Land Management (BLM) with the BLM serving as administrative lead.

We welcome your comments on this DEIS. Those comments addressing the adequacy of the scope of this DEIS or the impact analysis will be responded to in the final EIS. Specific comments are the most useful. These include suggestions for alternative data sources or impact analysis methodologies. All comments will be considered in the decisionmaking process.

Please keep this copy of the DEIS, as an abbreviated final EIS may be issued in accord with the Council on Environmental Quality (CEQ) regulations. A copy of the FEIS will be sent to all those on the DEIS mailing list and anyone requesting a copy.

In accord with the CEQ regulations, this draft incorporates a number of other documents by reference. The supporting technical reports for this EIS can be obtained from the address shown below.

All written comments should be received no later than October 12, 1987, and should be sent to:

Mr. Alfred Reuter
Sohare Creek Project Leader
Bridger-Teton National Forest
P.O. Box 1888
Jackson, Wyoming 83001

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

As indicated elsewhere in this DEIS, a public hearing will be held to receive oral/written comments.

Sincerely,

Brian Stout
Forest Supervisor
Bridger-Teton National Forest
Forest Service

Donald H. Sweep
District Manager
Rock Springs District
Bureau of Land Management

SOHARE CREEK UNIT EXPLORATORY
OIL WELL NO. 1-35
DRAFT
ENVIRONMENTAL IMPACT STATEMENT

Prepared by

U.S. Department of the Interior, Bureau of Land Management

U.S. Department of Agriculture, Forest Service

Gary Holsan, Environmental Planning

Brian E. Stout
Forest Supervisor
Bridger-Teton National Forest
Forest Service

Donald H. Sweep
District Manager
Rock Springs District Office
Bureau of Land Management

Retain this draft EIS for use with the final statement

August 1987

COVER SHEET

SOHARE CREEK UNIT EXPLORATORY OIL WELL No. 1-35
DRAFT ENVIRONMENTAL IMPACT STATEMENT

(X) DRAFT	( ) FINAL
Joint Lead Agencies	U.S. Department of the Interior Bureau of Land Management Rock Springs District P.O. Box 1869 Rock Springs, Wyoming 82002
	U.S. Department of Agriculture Forest Service Bridger-Teton National Forest P.O. Box 1888 Jackson, Wyoming 83001
Cooperating Agencies	U.S. Department of the Interior Fish & Wildlife Service
	U.S. Department of the Army, Corps of Engineers
	U.S. Environmental Protection Agency
Counties That Could Be Directly Affected	Teton and Fremont Counties, Wyoming

ABSTRACT

Amoco Production Company proposes to develop, produce, and transport oil from an exploratory well in northwestern Wyoming.

This Draft Environmental Impact Statement (DEIS) analyzes the environmental effects of the proposed well development, including the construction and operation of an access road and well pad in Teton County, Wyoming.

This DEIS analyzes the impacts of the Proposed Action, drilling the exploratory well with an access road from the north (Kettle Creek), and four access alternatives: the Sohare Creek, Sohare Creek Modified, and two helicopter Alternatives. The No-Action Alternative is also analyzed.

Based on the issues and concern identified during the scoping process, the DEIS focuses on the impacts to socioeconomics, wildlife, recreation, visual resources, soils and water resources. Key issues include effects to communities and people in established recreational uses; effects on visual quality levels; effects on soil stability; and effects on stream water quality.

DEIS Contact:

Comments on this DEIS should be directed to:

Alfred Reuter
Sohare Creek Project Leader
Bridger-Teton National Forest
P.O. Box 1888
Jackson, Wyoming 83001

(307) 733-4755

Date By Which Comments Must Be Received: October 12, 1987

PUBLIC HEARINGS INFORMATION

A public hearing on the Sohare Creek Unit Exploratory Oil Well No. 1-35 Draft Environmental Impact Statement will be held at the following location:

Wednesday, September 2, 1987
Americana Snow King Resort
400 East Snow King Drive
Jackson, Wyoming

The hearing will begin at 7:00 p.m.

The hearing will be held pursuant to the objectives of the National Environmental Policy Act (?L9-1190; 83 Stat. 852, 853) to receive comments (testimony) on the scope of the DEIS and the adequacy of the impact analysis. Testimony presented at the hearing will be considered in the preparation of the final environmental impact statement (FEIS).

The public hearing will be conducted by the Bureau of Land Management (BLM) official who will be accompanied by the panel of BLM, FS, and other federal personnel involved in preparing this draft environmental impact statement. The panel members may ask questions of the witness to clarify points in the testimony. All hearing proceedings will be recorded.

Before giving testimony at the public hearing, participants are requested to complete a hearing registration form. **A REGISTRATION FORM IS INCORPORATED AS THE LAST PAGE OF THIS DOCUMENT.** Additional forms may be obtained from the address shown on the registration form. Registration forms must be returned to that address no later than August 26, 1987. Participants may also register at the registration desk at the hearing.

Time preferences for presentation of oral statements will be honored, whenever possible. A tentative listing of speakers, in the order they will be called, will be available at the registration desk at the hearing.

After the last witness has been heard, the Hearings Administrator will consider the requests of other persons present who wish to testify. Only one witness will be allowed to present the viewpoint of the single organization at the hearing. However, any witness will be permitted to give relevant testimony if it is offered as the opinion of a private citizen.

Persons wishing to give oral testimony will be limited to 10 minutes. Written submissions may also be presented at the hearing.

PREFACE

This Draft Environmental Impact Statement (DEIS) presents facts and analyzes the environmental effects pertaining to the Proposed Action and Alternatives for the development of an exploratory oil well, including the construction and operation of an access road and well pad and potential helicopter access during well construction. This DEIS provides pertinent information in sufficient detail for the public to understand the project.

The DEIS has been prepared according to the requirements of the National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality's regulations for implementing NEPA, effective July 30, 1979.

In addition to the seven chapters and the appendices in the EIS, there are separate technical reports which support the EIS. Technical reports were prepared on the following topics:

- Socioeconomics
- Wildlife
- Fisheries
- Health and Safety
- Water Resources
- Visual Resources
- Transportation
- Recreation
- Soils
- Vegetation, Timber, and Range Resources

The technical reports are bound in one document and can be obtained from the Bureau of Land Management, in Rock Springs, Wyoming, and Forest Service offices in Jackson and Moran, Wyoming.

S.0 SUMMARY

S.1 BACKGROUND

This draft Environmental Impact Statement (DEIS) analyzes the impacts of drilling and production from an exploratory oil well in the Sohare Creek drainage, Bridger-Teton National Forest. The proposed site is located in Section 35, T43N, R112W, Teton County, Wyoming, about 45 road miles northeast of Jackson, Wyoming.

Amoco Production Company of Riverton, Wyoming, the proponent of the exploratory drilling action, filed a Notice of Staking (NOS) with the Bureau of Land Management (BLM) on October 17, 1985, and an Application for Permit to Drill (APD) on November 12, 1985. A Scoping Statement covering the proposed well and access alternatives was issued by the Bridger-Teton National Forest on October 30, 1985 in order to solicit public comment. An Environmental Assessment (EA) was completed for the drilling proposal in December 1986. The environmental analysis of the Amoco proposal, including alternatives, was developed through interdisciplinary field review with representatives from the BLM, the U.S. Forest Service (FS), and Amoco Production Company. Interdisciplinary participation was provided by private consultants working under the direction of, and in cooperation with the FS and BLM.

The Amoco Production Company Sohare Creek Unit Exploratory Oil Well No. 1-35 EIS is being prepared in response to the FS and BLM Decision/Rationale contained in the Sohare Creek Unit Exploratory Oil Well EA. Based on the evaluation of the potential adverse environmental effects and proposed mitigation measures documented in the EA, the responsible officials for the project concluded that the Amoco proposal may significantly affect the human environment. They further concluded that an EIS would be required to enable the FS and BLM to ensure that the final decision is informed and based on relevant factors and that the full National Environmental Policy Act (NEPA) process would result in enforceable mitigation measures through the Record of Decision. The agencies' rationale supporting this decision is as follows:

- Access road and drill site construction within the analysis area would be highly controversial. This conclusion was based on public response to timber sale proposals within and adjacent to the analysis area.

- The Amoco proposal may be inconsistent with the proposed Bridger-Teton National Forest Land and Resource Management Plan. This plan proposes a management prescription (MP)

along the southern access route alternatives and the drill site area emphasizing primitive recreation management (MP-2A). The northern access route alternative emphasizes grizzly bear conservation (MP-7). Also, MP-2A allows drilling only with full obliteration of access roads, and MP-7 recommends no leasing in order to avoid cumulative effects of roads and drilling activities on the grizzly bear. Draft direction, as stated here, could be interpreted as having significant effects on the quality of the human environment if carried into the final Forest Plan.

- Segments of all access alternatives to the drill site have sideslopes in excess of 40 percent. Stipulations provided in the Sohare Creek Unit Agreement prohibit disturbance of slopes in excess of 40 percent, unless the proponent can demonstrate through a detailed plan that satisfactory construction, operation, maintenance, and rehabilitation of roads traversing these slopes is feasible. An acceptable plan, approved by the BLM and FS, would be required before the 40 percent sideslope Unit Agreement Stipulation is waived. It was also concluded that further detailed assessment of the adverse potential impacts that could result from traversing steep slopes and identification of acceptable mitigation measures is required to conduct an informed consideration of the 40 percent sideslope stipulation waiver.

- The EA generally assumed an unproductive well in the discussion of potential environmental consequences. A reasonably foreseeable occurrence is that this well may prove to be productive, with an approved access road maintained and regularly used for a number of years. In this event, the "no effect" determination in the EA biological evaluation for the grizzly bear would be inappropriate. Such events may affect grizzly bear conservation, and formal consultation with the U.S. Fish and Wildlife Service (FWS) is required.

- Helicopter access, as described in the EA, introduces potentially significant adverse impacts of noise on recreationists and wildlife. These impacts and concerns must be addressed more thoroughly.

- A third roading alternative (not evaluated in the EA) was identified during internal agency review. This alternative should be further developed, including assessment of potential impacts and identification of appropriate mitigation measures, in order to assure that all reasonable alternatives have been analyzed.

S.2 PROPOSED ACTION AND ALTERNATIVES

Amoco Production Company of Riverton, Wyoming proposes to drill and produce from an 11,050-foot exploratory oil well on the Jackson Ranger District, Bridger-Teton National Forest. The drilling and production proposal, known as the Sohare Creek Unit Exploratory Oil Well No. 1-35, is located in the Sohare Creek drainage, a tributary to the Gros Ventre River, Teton County, Wyoming. The drill site is located in the SW 1/4 of Section 35, T43N, R112W (Exhibit 1-1). Access to the proposed site would utilize 18.6 miles of the existing Flagstaff and Leidy Creek Roads south from U.S. Highway 26-287 as shown on Exhibit 1-1 (Alternative A). An additional 3.3 miles of new road construction would be required in the Kettle Creek and upper Sohare Creek drainages.

A worker campsite to house drilling-related personnel on location is planned. The camp would be designed to hold a maximum of 30 people and would be located adjacent to the drill site in order to centralize the drilling operation, to reduce the total amount of site disturbance involved with construction, and to utilize the drilling rigs electrical power source for the worker campsite service needs. Total area of disturbance, including the drill site, production facilities, campsite, and access road would be approximately 26.0 acres.

Alternatives to the proposed action, as identified through interdisciplinary review, include two alternate routes of road access to the proposed drill site; a helicopter mobilization and support alternative; and the alternative of "No Action". Roading alternatives to Amoco's proposal and the helicopter mobilization alternative are briefly described as follows:

- Alternative B - This alternative would include accessing the drill site by utilizing U.S. Highway 89-187 north from Jackson, Wyoming, the Gros Ventre Road from the Gros Ventre Junction, and the Cottonwood Creek Road from its junction with the Gros Ventre Road (Exhibits 1-1 and 2-1). Heavy reconstruction and major realignment of the Cottonwood Creek Road would be required for approximately 7.2 miles. New road construction would begin at the end of the Cottonwood Creek Road near the junction of Sohare Creek and Cottonwood Creek. The section of new access would proceed northwest into the Sohare Creek drainage. Total length of new access road construction would be 6.0 miles. Total area of disturbance (drill site, campsite, and access road) would be approximately 86.0 acres.

- Alternative C - This alternative would utilize the same primary access described in the Alternative B description, but would be modified in the Sohare Creek drainage (Exhibit

2-1). New construction would begin at the end of the Cottonwood Creek Road, but rather than routing the road out of the Sohare drainage and up a series of switchbacks to the drill site, the route would parallel Sohare Creek. Total length of new access road construction would be 4.4 miles, with a total area of disturbance of approximately 76.3 acres.

This roading alternative was not evaluated in the Sohare Creek Unit EA. Rather, this is the third roading alternative identified during internal agency review of the EA.

- Alternative D - Access under this helicopter mobilization and support alternative would require reconstruction or improvement of existing roads as described under the various roading alternatives, depending on the helicopter staging area selected. Two staging areas were identified during interdisciplinary review (Exhibit 2-1). The D1 alternative is located on a flat bench area north of Kettle Creek to the north of the drill site and the D2 alternative is located to the south of the drill site on a large bench area in the Dry Cottonwood drainage. All drilling-related equipment and support materials would be transported via helicopter from one of the two identified staging areas to the drill site. The drill rig would be mobilized to the staging area by conventional truck transport methods. No new road construction would be required to access either staging area. Total area of disturbance would be 4 acres for either staging area, and the total approximate area of disturbance, including drill site and worker camp, would be 10 acres.

- No Action Alternative - The fifth alternative to be analyzed is the alternative of "No Action". For the Amoco proposal, the No Action Alternative would result in denial of the APD. This alternative would provide for the continuance of other land management activities presently occurring in the project area. However, the Department of the Interior's authority to implement a No Action Alternative is limited. An explanation of this limitation and the latitude the Department has in this regard is discussed in Chapter 2.

S.3 SCOPE OF ANALYSIS

Public issues and comments regarding the Amoco proposal were solicited for incorporation into the project EA through the scoping process. A Scoping Statement that described the action to be analyzed in the Environmental Assessment, identified preliminary issues and concerns, and established timing needs or requirements for public involvement was prepared and submitted to the public (October 30, 1985). Issues and concerns identified during the scoping period were incorporated into the EA.

Following the decision by the responsible officials that preparation of an EIS was necessary to answer unresolved issues, a follow-up Scoping Statement was prepared and distributed to the public (January 26, 1987) requesting comment regarding the Amoco proposal for incorporation into the EIS. Based on public scoping, important issues identified concerned impacts to the following resource values: recreation, wildlife, socioeconomic, visual, soils, livestock grazing, vegetation, water quality, watershed, and health and safety. However, the issues of greatest concern are summarized as follows:

- Impacts on elk calving grounds and historic migration routes, critical big game winter range, and grizzly bear Management Situation 1 and 2 habitat.
- Impacts of a new road into an area currently unroaded.
- Impacts on established recreational snowmobiling and on high level year-round recreation use.
- Effects on big game hunting and outfitter/guide operations.
- Potential for increased erosion and stream sedimentation and reclamation success limitation resulting from construction on unstable soils and steep slopes.

S.4 MAJOR IMPACT CONCLUSIONS

Drilling of the Amoco Production Company Sohare Creek Unit Exploratory Oil Well No. 1-35 would cause short-term and long-term disturbance to and displacement of the human and natural environments. Potential environmental impacts that could result from implementation of the proposed action or alternatives are detailed in Chapter 4 of the EIS, with a comparative analysis in Chapter 5. Proposed mitigation measures are included in Chapter 6.

The proposed drilling action would result in major new road construction and reconstruction of existing roads. Major issues and impacts associated with the drilling action need to be stressed and are included in the following summary.

S.4.1 Geology

The Sohare Creek Unit lies on the edge of Zone 2 and Zone 3 seismic risk areas. While no seismic risk to well integrity is expected, earthquakes could potentially affect access roads by triggering landslides and possible road subsidence.

S.4.2 Air Quality

Implementation of the proposed action would have no significant impact on air quality either in the short or long term.

S.4.3 Transportation

Short-term adverse impacts to transportation would result from implementation of any of the proposed alternatives. These impacts would occur only during certain phases of the project and would include decreased service levels and interruption of traffic flow due to repairs and maintenance of existing roads.

Slope instability could result from the construction of new roads and the upgrading of existing roads on slopes exceeding 40 percent. The extent of construction that would occur on such slopes would vary between access alternatives and is analyzed in detail in Section 4.3.

S.4.4 Soil Resources

All roading alternatives under consideration have segments of steep slopes that would be difficult to reclaim. Special planning and aggressive revegetation efforts would be required to restore near-present soil contours and productivity along these segments. These impacts are described in detail in Section 4.4.

S.4.5 Water Resources

Construction and operation of access roads within 500 feet of a stream environment could cause increased erosion and subsequent sedimentation in streams. Access roads crossing streams would increase sedimentation through channel bed disruption and channel bed readjustment, thus degrading water quality. The potential exists for contamination of surface water by spilled fuel or drilling fluid and contamination of freshwater aquifers by drilling fluids or mixing of ground water. If successfully implemented, mitigation measures would greatly reduce the potential of these impacts occurring. These impacts are described in detail in Section 4.5.

S.4.6 Fisheries

Upgrade and construction of new access roads could increase sediment loading in streams, which in turn could result in a reduction in fish populations or available habitat. Alteration of channels due to road construction would increase sedimentation through channel bed disruption and channel bed readjustment, thus degrading water quality due to increased sedimentation. These impacts are described in detail in Section 4.6.

S.4.7 Vegetation, Timber, and Range Resources

Impacts to these resources directly relate to the clearing and disturbance of vegetation due to drill site and access road construction. Wetlands are of particular importance as a sensitive and unique community type which is protected under the Clean Water Act. Forested stands dominated by whitebark pine would be disturbed, which would be of importance because grizzly bears utilize the nuts produced by these trees for fall forage. Timber resources could be lost due to direct removal of trees. Increased access to timber stands with commercially valuable timber could be a benefit of the project. Range resources could be impacted through the reduction of forage, altered livestock movement and management, and increased potential for livestock-/vehicle collision resulting in death. These impacts are described in detail in Section 4.7.

S.4.8 Wildlife

Unavoidable adverse impacts to wildlife would occur throughout the life of the proposed action. These would include loss of wildlife habitat; increased potential for wildlife injury, stress and mortality resulting from activities related to construction and operation; displacement of sensitive wildlife species; increased potential for encounters between grizzly bears and humans; increased potential for disruption and mortality of wildlife from increased use of the area by the general public; a reduction in the quality of big game hunting; a reduction of habitat effectiveness and displacement of individuals; and reduction of grizzly bear habitat effectiveness and displacement of individuals. The extent and magnitude of these adverse impacts would vary between access alternatives. These impacts are analyzed in detail in Section 4.8.

S.4.9 Visual Resources

In the short term, the proposed action and any of the alternatives would have a significant adverse affect on the visual resources by exceeding visual quality levels (VQL) established by the Forest Service. In the long term, the proposed action could meet current specified visual quality objectives if reclamation was successfully implemented. If the well was productive, visual impacts associated with access to the drill site would be significant because the designated VQL would be exceeded. Specific visual resource acreages that would likely be affected by the proposed action are identified in Section 4.9.

S.4.10 Recreation

The proposed action would require changes in current Recreation Opportunity Spectrum (ROS) classifications in portions of the

project area. This would include changes in areas currently classified as Primitive to Semi-Primitive Non-Motorized; areas currently classified as Primitive to Roaded Natural; and areas currently classified as Semi-Primitive Non-Motorized to Roaded Natural. During the drilling operation, no significant impact would occur to dispersed recreationists, including hunters, since they would be displaced for only one season. However, if production from the one well occurs, these users would be displaced for the duration of the project. The long-term displacement of these users could indirectly impact the recreation experiences of users in adjacent areas that displaced users would likely turn to as an alternative. These impacts are described in detail in Section 4.10.

S.4.11 Socioeconomics

No direct significant impacts would occur to the social environment in the short term under the proposed action or alternatives. However, if the well went into production, the probable changes in lifestyles of recreationists and outfitters that would be partially or totally displaced as a result of activities associated with production would be considered significant.

The proposed action would not cause significant economic impact to commercial and non-commercial outdoor recreation-oriented activities under the exploratory drilling proposal. However, under production from this single exploratory well, the long-term impact of displacement of outfitted and non-outfitted elk hunters and snowmobilers from the affected area could be significant. Of particular concern would be the displacement of the outfitter. Serious economic hardship would result since long-term displacement or elimination of the outfitting operation could occur during one-well production. These impacts are described in detail in Section 4.11.

S.4.12 Cultural Resources

No determination of impacts to cultural resources can be made until an inventory of these resources is completed.

S.4.13 Health and Safety

Although the likelihood is low, the most significant health and safety hazards associated with implementation of the proposed action would be the potential for accidental release of hydrogen sulfide gas. If the site is serviced by helicopter, additional hazards would be created by the possible lack of transportation from the drill site in the event of an accident or natural disaster. These impacts are described in detail in Section 4.13.

S.4.14 Land Use Constraints and Conflicts

Conflicts between existing and expected land use plans and alternatives for the proposed action include road closures on Spread Creek and the Gros Ventre River during spring runoff; planning associated with domestic livestock during June; relocation of at least one hunting camp; new bridge construction and reconstruction of existing bridges; placement of gates and gate guards at road closure locations; and possible ROW closures. The potential presence of grizzly bears within the project area would require a number of land use constraints to provide protection to the grizzly bear and its habitat.

S.5 MITIGATION AND MONITORING

Mitigation measures and monitoring requirements have been identified through the analysis of potential impacts in Chapter 4, Environmental Consequences. These measures and requirements are summarized in Chapter 6, Mitigation and Monitoring. The measures and requirements describe how construction, drilling, operations, production, and reclamation should be managed to assure compliance with the applicable lease and unit stipulations and resource limitations identified during the interdisciplinary analysis.

S.6 AGENCY PREFERRED ALTERNATIVE

The BLM and FS, on the basis of the analysis in this draft EIS have determined that the proposed exploratory drilling and production (if a discovery is made) would be consistent with the present Bridger-Teton National Forest management directive for the affected area. Alternative A is the Agency Preferred Alternative. Alternative A is to drill the well at the proposed location, using the northern access route, under the following conditions:

(a) A Geotechnical Road Feasibility Evaluation and Report must be completed for Alternative A (see pages 2-8 through 2-11) between the draft and final EIS. The purpose of the report would be to help determine if road construction, operation, maintenance, and reclamation is feasible and economical on slopes greater than 40 percent and within 500 feet of a stream. Lease stipulations and the unit agreement currently prohibit construction under these conditions. The authorization of the Agency Preferred Alternative would require approval of exceptions to these requirements. The study would provide the detailed information needed to determine if the exceptions could be approved, prior to selection of a preferred alternative in the final EIS.

(b) If the discovery is made, production from the one well would not commence until an analysis of production facilities (e.g. pipelines) and consultation with the U.S. Fish and Wildlife Service is completed. Further exploration or development in the area would not be approved until an analysis of field development (an additional one or more wells) has been completed in a subsequent environmental analysis.

(c) The compensatory measures (Chapter 6, and Appendix E, Biological Assessment) would be required to ensure that the grizzly bear and its habitat are not impaired. However, this would be contingent upon a U.S. Fish and Wildlife Service Biological Opinion that concurs with the Agencies' biological assessment conclusion (Appendix E) that the authorization of Alternative A would not be expected to jeopardize the existence of the grizzly bear.

(d) All applicable mitigation measures and monitoring requirements (Chapter 6) which are within the authority of the agencies to enforce would be required.

TABLE OF CONTENTS

S.0 SUMMARY S-1

S.1 BACKGROUND S-1

S.2 PROPOSED ACTION AND ALTERNATIVES S-3

S.3 SCOPE OF ANALYSIS S-4

S.4 MAJOR IMPACT CONCLUSIONS S-5

S.4.1 Geology S-5
S.4.2 Air Quality S-6
S.4.3 Transportation S-6
S.4.4 Soil Resources S-6
S.4.5 Water Resources S-6
S.4.6 Fisheries S-6
S.4.7 Vegetation, Timber, and Range Resources . . . S-7
S.4.8 Wildlife S-7
S.4.9 Visual Resources S-7
S.4.10 Recreation S-7
S.4.11 Socioeconomics S-8
S.4.12 Cultural Resources S-8
S.4.13 Health and Safety S-8
S.4.14 Land Use Constraints and Conflicts S-9

S.5 MITIGATION AND MONITORING S-9

S.6 AGENCY PREFERRED ALTERNATIVE S-9

1.0 INTRODUCTION 1-1

1.1 PROJECT LOCATION AND DESCRIPTION 1-1

1.2 PURPOSE AND NEED FOR ACTION 1-1

1.3 ENVIRONMENTAL ANALYSIS PROCESS 1-3

1.4 LAND STATUS, LEGAL, AND POLICY CONSIDERATIONS 1-4

1.4.1 Land Status 1-4
1.4.2 Lease Stipulations 1-4
1.4.3 Unit Stipulations 1-5
1.4.4 Field Development Considerations 1-6

1.5 AUTHORIZING ACTIONS 1-8

1.6 ISSUES AND CONCERNS 1-8

1.7 OPPORTUNITIES 1-12

TABLE OF CONTENTS CONTINUED

2.0 PROPOSED ACTION AND ALTERNATIVES 2-1

2.1 INTRODUCTION 2-1

2.2 DESCRIPTION OF ALTERNATIVES 2-2

2.2.1 Project Area 2-2
2.2.2 Alternative A (Proposed Action) 2-2
2.2.3 Alternative B 2-16
2.2.4 Alternative C 2-17
2.2.5 Alternative D 2-18
2.2.6 No Action Alternative 2-21
2.2.7 Alternatives Considered But Not Analyzed in Detail 2-25

2.3 SUMMARY COMPARISON OF ALTERNATIVES 2-26

3.0 AFFECTED ENVIRONMENT 3-1

3.1 GEOLOGY/PALEONTOLOGY 3-1

3.1.1 Geology 3-1
3.1.2 Seismic Risk 3-2
3.1.3 Paleontology 3-2

3.2 AIR QUALITY 3-4

3.2.1 Introduction 3-4
3.2.2 Drill Site 3-5
3.2.3 Access Alternatives 3-5

3.3 TRANSPORTATION 3-5

3.3.1 Introduction 3-5
3.3.2 Drill Site 3-7
3.3.3 Access Alternatives 3-7
3.3.3.1 Alternative A 3-7
3.3.3.1.1 Existing Roads 3-7
3.3.3.1.2 Road Use 3-8
3.3.3.2 Alternative B 3-8
3.3.3.2.1 Existing Roads 3-8
3.3.3.2.2 Road Use 3-9
3.3.3.3 Alternative C 3-10
3.3.3.4 Alternative D 3-10
3.3.3.4.1 Alternative D1 3-10
3.3.3.4.2 Alternative D2 3-10

TABLE OF CONTENTS CONTINUED

3.4 SOILS 3-10

3.4.1 Introduction 3-10
3.4.2 Drill Site 3-12
3.4.3 Access Alternatives 3-12
3.4.3.1 Alternative A 3-12
3.4.3.2 Alternative B 3-12
3.4.3.3 Alternative C 3-14
3.4.3.4 Alternative D 3-14

3.5 WATER RESOURCES 3-14

3.5.1 Introduction 3-14
3.5.2 Drill Site 3-16
3.5.3 Access Alternatives 3-17
3.5.3.1 Alternative A 3-17
3.5.3.2 Alternative B 3-17
3.5.3.3 Alternative C 3-18
3.5.3.4 Alternative D 3-19
3.5.3.4.1 Northern Staging Area (D1) . . 3-19
3.5.3.4.2 Southern Staging Area (D2) . . 3-19

3.6 FISHERIES 3-19

3.6.1 Introduction 3-19
3.6.2 Drill Site 3-19
3.6.3 Access Alternatives 3-20
3.6.3.1 Alternative A 3-20
3.6.3.2 Alternative B 3-20
3.6.3.3 Alternative C 3-20
3.6.3.4 Alternative D 3-20
3.6.3.4.1 Northern Staging Area (D1) . . 3-20
3.6.3.4.2 Southern Staging Area (D2) . . 3-20

3.7 VEGETATION, TIMBER, AND RANGE RESOURCES 3-21

3.7.1 Introduction 3-21
3.7.2 Drill Site 3-26
3.7.3 Access Alternatives 3-26
3.7.3.1 Alternative A 3-26
3.7.3.2 Alternative B 3-27
3.7.3.3 Alternative C 3-27
3.7.3.4 Alternative D 3-28
3.7.3.4.1 Northern Staging Area (D1) . . 3-28
3.7.3.4.2 Southern Staging Area (D2) . . 3-28

TABLE OF CONTENTS CONTINUED

3.8 WILDLIFE 3-28

3.8.1 Introduction 3-28
3.8.2 Drill Site 3-30
3.8.3 Access Alternatives 3-30
3.8.3.1 Alternative A 3-30
3.8.3.2 Alternatives B and C 3-30
3.8.3.3 Alternative D 3-34
3.8.3.3.1 Northern Staging Area (D1) . . 3-34
3.8.3.3.2 Southern Staging Area (D2) . . 3-34

3.9 VISUAL RESOURCES 3-35

3.9.1 Introduction 3-35
3.9.2 Drill Site 3-35
3.9.3 Access Alternatives 3-40
3.9.3.1 Alternative A 3-40
3.9.3.2 Alternative B 3-40
3.9.3.3 Alternative C 3-41
3.9.3.4 Alternative D 3-41
3.9.3.4.1 Northern Staging Area (D1) . . 3-41
3.9.3.4.2 Southern Staging Area (D2) . . 3-41

3.10 RECREATION 3-41

3.10.1 Introduction 3-41
3.10.2 Drill Site 3-41
3.10.3 Access Alternatives 3-43
3.10.3.1 Alternative A 3-43
3.10.3.2 Alternative B 3-45
3.10.3.3 Alternative C 3-47
3.10.3.4 Alternative D 3-47
3.10.3.4.1 Northern Staging Area (D1) . . 3-47
3.10.3.4.2 Southern Staging Area (D2) . . 3-48

3.11 SOCIOECONOMICS 3-48

3.11.1 Introduction 3-48
3.11.2 Drill Site 3-49
3.11.3 Access Alternatives 3-50
3.11.3.1 Alternative A 3-50
3.11.3.2 Alternative B 3-50
3.11.3.3 Alternative C 3-51
3.11.3.4 Alternative D 3-51
3.11.3.4.1 Northern Staging Area (D1) . . 3-51
3.11.3.4.2 Southern Staging Area (D2) . . 3-51

TABLE OF CONTENTS CONTINUED

3.12 CULTURAL RESOURCES 3-51

3.12.1 Introduction 3-51
3.12.1.1 Prehistoric Period 3-52
3.12.1.2 Proto-Historic and Historic Periods . 3-53
3.12.2 Drill Site 3-54
3.12.3 Access Alternatives 3-54

3.13 LAND USE CONSTRAINTS AND CONFLICTS 3-54

3.13.1 Introduction 3-54

4.0 ENVIRONMENTAL CONSEQUENCES 4-1

4.1 GEOLOGY/PALEONTOLOGY 4-2

4.1.1 Introduction 4-2
4.1.2 Impact Significance Criteria 4-2
4.1.3 Direct and Indirect Impacts 4-3
4.1.3.1 Drill Site 4-3
4.1.3.2 Access Alternatives 4-3
4.1.4 Impacts Summary 4-4
4.1.5 Cumulative Impacts 4-4
4.1.6 Mitigation Summary 4-4
4.1.7 Unavoidable Adverse Impacts 4-4

4.2 AIR QUALITY 4-4

4.2.1 Introduction 4-4
4.2.2 Impact Significance Criteria 4-5
4.2.3 Direct and Indirect Impacts 4-5
4.2.4 Impacts Summary 4-5
4.2.5 Cumulative Impacts 4-5
4.2.6 Mitigation Summary 4-5
4.2.7 Unavoidable Adverse Impacts 4-6

4.3 TRANSPORTATION 4-6

4.3.1 Introduction 4-6
4.3.2 Impact Significance Criteria 4-6
4.3.3 Direct and Indirect Impacts 4-6
4.3.3.1 Drill Site 4-6
4.3.3.2 Access Alternatives 4-7
4.3.3.2.1 Alternative A 4-8
4.3.3.2.2 Alternative B 4-8
4.3.3.2.3 Alternative C 4-9
4.3.3.2.4 Alternative D 4-9
4.3.4 Impacts Summary 4-10

4.3.5 Cumulative Impacts 4-10
4.3.6 Mitigation Summary 4-10

4.4 SOILS 4-11

4.4.1 Introduction 4-11
4.4.2 Impact Significance Criteria 4-12
4.4.3 Direct and Indirect Impacts 4-14
4.4.3.1 Drill Site 4-14
4.4.3.2 Access Alternatives 4-15
4.4.3.2.1 Alternative A 4-15
4.4.3.2.2 Alternative B 4-15
4.4.3.2.3 Alternative C 4-15
4.4.3.2.4 Alternative D 4-16
4.4.4 Impacts Summary 4-16
4.4.5 Cumulative Impacts 4-17
4.4.6 Mitigation Summary 4-17
4.4.7 Unavoidable Adverse Impacts 4-17

4.5 WATER RESOURCES 4-18

4.5.1 Introduction 4-18
4.5.2 Impact Significance Criteria 4-19
4.5.3 Direct and Indirect Impacts 4-20
4.5.3.1 Drill Site 4-20
4.5.3.2 Access Alternatives 4-21
4.5.3.2.1 Alternative A 4-21
4.5.3.2.2 Alternative B 4-22
4.5.3.2.3 Alternative C 4-23
4.5.3.2.4 Alternative D 4-23
4.5.4 Impacts Summary 4-23
4.5.4.1 Drill Site 4-23
4.5.4.2 Access Alternatives 4-24
4.5.5 Cumulative Impacts 4-24
4.5.6 Mitigation Summary 4-24
4.5.7 Unavoidable Adverse Impacts 4-26
4.5.7.1 Drill Site 4-26
4.5.7.2 Access Alternatives 4-26

4.6 FISHERIES 4-26

4.6.1 Introduction 4-26
4.6.2 Impact Significance Criteria 4-27
4.6.3 Direct and Indirect Impacts 4-27
4.6.3.1 Drill Site 4-27
4.6.3.2 Access Alternatives 4-28
4.6.3.2.1 Alternative A 4-28
4.6.3.2.2 Alternative B 4-28
4.6.3.2.3 Alternative C 4-28
4.6.3.2.4 Alternative D 4-29

4.6.4 Impacts Summary 4-29
4.6.5 Cumulative Impacts 4-29
4.6.6 Mitigation Summary 4-29
4.6.7 Unavoidable Adverse Impacts 4-30

4.7 VEGETATION, TIMBER, AND RANGE RESOURCES 4-30

4.7.1 Introduction 4-30
4.7.2 Impact Significance Criteria 4-32
4.7.3 Direct and Indirect Impacts 4-33
4.7.3.1 Drill Site 4-33
4.7.3.2 Access Alternatives 4-33
4.7.3.2.1 Alternative A 4-33
4.7.3.2.2 Alternative B 4-34
4.7.3.2.3 Alternative C 4-34
4.7.3.2.4 Alternative D 4-35
4.7.4 Impacts Summary 4-35
4.7.5 Cumulative Impacts 4-36
4.7.6 Mitigation Summary 4-37
4.7.7 Unavoidable Adverse Impacts 4-37

4.8 WILDLIFE 4-37

4.8.1 Introduction 4-37
4.8.2 Impact Significance Criteria 4-39
4.8.3 Direct and Indirect Impacts 4-40
4.8.3.1 Drill Site 4-40
4.8.3.2 Access Alternatives 4-40
4.8.3.2.1 Alternative A 4-40
4.8.3.2.2 Alternative B 4-42
4.8.3.2.3 Alternative C 4-44
4.8.3.2.4 Alternative D 4-44
4.8.4 Impacts Summary 4-47
4.8.5 Cumulative Impacts 4-49
4.8.6 Mitigation Summary 4-50
4.8.6.1 Drill Site 4-51
4.8.6.2 Access Alternatives 4-52
4.8.7 Unavoidable Adverse Impacts 4-54

4.9 VISUAL RESOURCES 4-54

4.9.1 Introduction 4-54
4.9.2 Impact Significance Criteria 4-54
4.9.3 Direct and Indirect Impacts 4-55
4.9.3.1 Drill Site 4-55
4.9.3.2 Access Alternatives 4-55
4.9.3.2.1 Alternative A 4-55
4.9.3.2.2 Alternative B 4-57
4.9.3.2.3 Alternative C 4-58
4.9.3.2.4 Alternative D 4-58

4.9.3.3 Impacts Summary 4-59
4.9.4 Cumulative Impacts 4-60
4.9.5 Mitigation Summary 4-60
4.9.6 Unavoidable Adverse Impacts 4-61

4.10 RECREATION 4-61

4.10.1 Introduction 4-61
4.10.2 Impact Significance Criteria 4-62
4.10.3 Direct and Indirect Impacts 4-62
4.10.3.1 Drill Site 4-62
4.10.3.2 Access Alternatives 4-62
4.10.3.2.1 Alternative A 4-63
4.10.3.2.2 Alternative B 4-67
4.10.3.2.3 Alternative C 4-70
4.10.3.2.4 Alternative D 4-70
4.10.3.3 Impacts Summary 4-71
4.10.4 Cumulative Impacts 4-72
4.10.5 Mitigation Summary 4-72
4.10.6 Unavoidable Adverse Impacts 4-73

4.11 SOCIOECONOMICS 4-73

4.11.1 Introduction 4-73
4.11.2 Impact Significance Criteria 4-74
4.11.3 Direct and Indirect Impacts 4-74
4.11.3.1 Drill Site 4-74
4.11.3.2 Access Alternatives 4-75
4.11.3.2.1 Alternative A 4-75
4.11.3.2.1.1 Social Conditions 4-75
4.11.3.2.1.2 Economics 4-76
4.11.3.2.2 Alternative B 4-78
4.11.3.2.2.1 Social Conditions 4-78
4.11.3.2.2.2 Economics 4-79
4.11.3.2.3 Alternative C 4-81
4.11.3.2.3.1 Social Conditions 4-81
4.11.3.2.3.2 Economics 4-81
4.11.3.2.4 Alternative D 4-81
4.11.3.2.4.2 Economics 4-81
4.11.3.3 Impacts Summary 4-82
4.11.3.3.1 Social Conditions 4-82
4.11.3.3.2 Economics 4-82
4.11.4 Cumulative Impacts 4-87
4.11.5 Mitigation Summary 4-88
4.11.6 Unavoidable Adverse Impacts 4-88

TABLE OF CONTENTS CONTINUED

4.12 CULTURAL RESOURCES 4-88

4.12.1 Introduction 4-88
4.12.2 Impact Significance Criteria 4-89
4.12.3 Direct and Indirect Impacts 4-90
4.12.4 Cumulative Impacts 4-90
4.12.5 Mitigation Summary 4-90
4.12.6 Unavoidable Adverse Impacts 4-91

4.13 HEALTH AND SAFETY 4-91

4.13.1 Introduction 4-91
4.13.2 Impact Significance Criteria 4-91
4.13.3 Direct and Indirect Impacts 4-92
4.13.3.1 Drill Site 4-92
4.13.3.2 Access Alternatives 4-92
4.13.3.3 Impacts Summary 4-94
4.13.4 Cumulative Impacts 4-95
4.13.5 Mitigation Summary 4-95
4.13.6 Unavoidable Adverse Impacts 4-95

4.14 LAND USE CONSTRAINTS AND CONFLICTS 4-95

4.14.1 Introduction 4-95
4.14.2 Management Consistency 4-95

4.15 NO ACTION ALTERNATIVE 4-96

4.15.1 Introduction 4-96
4.15.2 No Action - Unconstrained 4-96
4.15.3 No Action - As Authorized by the Secretary of the Interior 4-99
4.15.4 No Action - As Authorized by Congress . . . 4-101

5.0 COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES 5-1

5.1 INTRODUCTION 5-1

5.2 DRILL SITE 5-1

5.3 ACCESS ALTERNATIVES 5-6

5.3.1 Alternative A 5-6
5.3.2 Alternative B 5-8
5.3.3 Alternative C 5-9
5.3.4 Alternative D 5-10

TABLE OF CONTENTS CONTINUED

5.4 SUMMARY 5-11

6.0 MITIGATION AND MONITORING 6-1

6.1 MITIGATION MEASURES 6-2

6.1.1 Administrative Measures 6-2
6.1.2 Preconstruction Planning and Design Measures . 6-4
6.1.2.1 General Measures 6-4
6.1.2.2 Resource-Specific Measures 6-6
6.1.3 Construction Measures 6-10
6.1.3.1 General Measures 6-10
6.1.3.2 Resource-Specific Measures 6-10
6.1.4 Reclamation Measures 6-18
6.1.4.1 General Measures 6-18
6.1.4.2 Resource-Specific Measures 6-19
6.1.5 Operation and Maintenance Measures 6-22
6.1.5.1 General Measures 6-22
6.1.5.2 Resource-Specific Measures 6-22
6.1.6 Abandonment Measures 6-26
6.1.6.1 General Measures 6-26

6.2 MONITORING REQUIREMENTS 6-27

6.2.1 General Requirements 6-27
6.2.2 Resource-Specific Requirements 6-27

7.0 CONSULTATION AND COORDINATION 7-1

7.1 INTRODUCTION 7-1

7.2 PUBLIC PARTICIPATION 7-1

7.3 PUBLIC INVOLVEMENT 7-2

7.3.1 Federal Government Agencies 7-2
7.3.2 State Government Agencies 7-3
7.3.3 Local Governments 7-3
7.3.4 Environmental Groups and Others 7-3
7.3.4 Others 7-3

7.4 LIST OF PREPARERS 7-4

TABLE OF CONTENTS CONTINUED

REFERENCES R-1

GLOSSARY G-1

ABBREVIATIONS G-8

APPENDICES

APPENDIX A FIELD DEVELOPMENT

APPENDIX B LEASE STIPULATIONS

APPENDIX C TECHNICAL APPENDICES
APPENDIX C-1 Vegetation, Range, and Timber Resources
APPENDIX C-2 Visual Resources
APPENDIX C-3 Recreation Resources
APPENDIX C-4 Soil Resources
APPENDIX C-5 Land Use

APPENDIX D H_2S CONTINGENCY PLAN

APPENDIX E BIOLOGICAL ASSESSMENT

LIST OF TABLES

Table Page

2-1 Helicopter Mobilization: Drill Site Equipment; Average Loads and Trips. 2-20

2-2 Denial Authority as Applicable to Oil and Gas Lease W-66212 and the Sohare Creek Unit Agreement. . . 2-24

2-3 Summary - Comparison of Alternatives 2-27

3-1 Conditions for Levels of Service 3-6

3-2 Summary of Soil Characteristics in the Project Area. 3-13

3-3 Elevation, Location, Average Maximum Snow Accumulation, and Snow Water Equivalents for Five Snow Course Stations near the Study Area 3-16

LIST OF TABLES

Table		Page
3-4	Summary of Cumulative Distances of each Vegetation Type that would be Traversed by New Road Construction for each Alternative.	3-23
3-5	Summary of Miles of Each Category of Sensitivity Level, Distance Zones, Variety Class, and Visual Quality Level that would be Traversed by the Access Alternatives	3-39
3-6	Land Use Plans, Inventories and Management Strategies	3-55
4-1	Summary of Sensitive Soils.	4-13
4-2	Reclamation Potential of Soils Disturbed due to Project Construction and Operation	4-14
4-3	Comparison of Characteristics of Each Alternative that could lead to Significant Impacts to Water Resources	4-25
4-4	Summary of Vegetation Clearing and Disturbance and Associated Loss of AUMs	4-37
4-5	Changes in Current Summer Level of Habitat Effectiveness in the Analysis Area.	4-48
4-6	Changes in Current Fall Level of Habitat Effectiveness in the Analysis Area.	4-50
4-7	Estimated Tax Implications of the Production Well	4-79
4-8	Economic Impact of Helicopter Access Assuming an Exploratory Well	4-83
4-9	Economic Impacts of Exploratory Well in Sohare Creek.	4-84
4-10	Economic Impacts of Producing Well in Sohare Creek Assuming 4 percent Discount Rate.	4-85
4-11	Economic Implacts of Producing Well in Sohare Creek Assuming 7.125 percent Discount Rate.	4-86
5-1	Comparison of Significant Unavoidable Adverse Impacts for the Proposed Action and Alternatives.	5-2

LIST OF EXHIBITS

Exhibit		Page
1-1	Location of the Project Area	1-2
2-1	Project Alternatives	2-3
2-2	Schematic of Drill Site and Worker Camp Layout	2-5
2-3	Typical Drill Site Layout	2-7
2-4	Relationship of hillslope gradient to cut and fill area and length associated with access road construction	2-9
2-5	Relationship of cut and fill length to hillslope gradient assuming 1:1 cut ratio	2-10
2-6	Schematic of proposed production facilities	2-14
3-1	Seismic Hazard Zones in the Project Area	3-3
3-2	Sensitive Soils along Access Alternatives	3-11
3-3	General Vegetation Types in the Study Area	3-22
3-4	Grazing Allotments and Units in the Project Area	3-25
3-5	Alternatives A and D1 Wildlife Map	3-31
3-6	Alternatives B, C, and D2 Wildlife Map	3-32
3-7	Elk Migration Corridors	3-33
3-8	Variety Classes	3-36
3-9	Sensitivity Levels and Distance Zones	3-37
3-10	Visual Quality Levels	3-38
3-11	Recreation Opportunity Spectrum Management Classes	3-42
4-1	Area with Visual Access to the Drill Site	4-56
4-2	Changes in Recreation Opportunity Spectrum Guidelines	4-64
4-3	Changes in Recreation Opportunity Spectrum Delineations for Alternatives B and C	4-68

CHAPTER 1

1.0 INTRODUCTION

1.1 PROJECT LOCATION AND DESCRIPTION

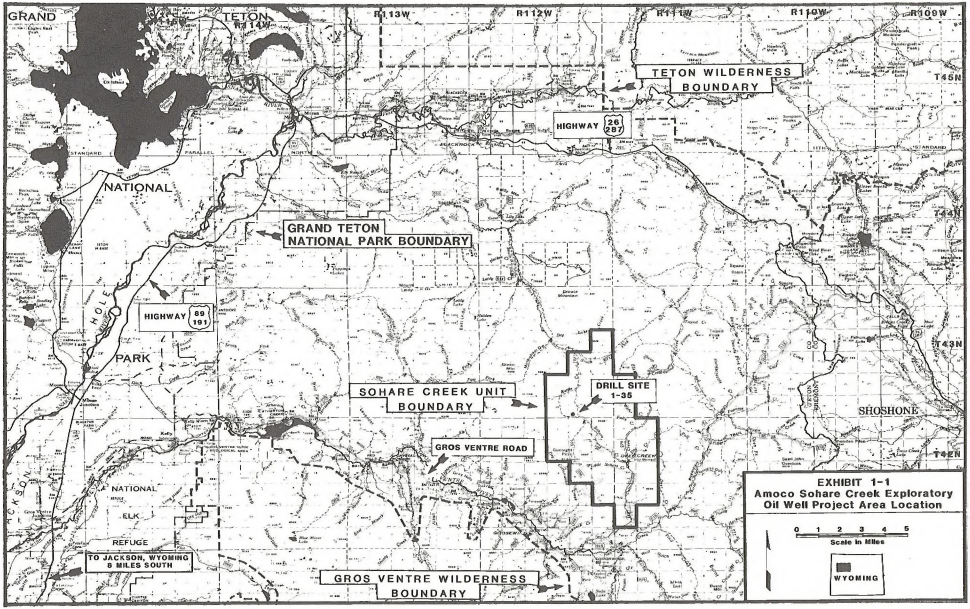
The Amoco drilling proposal, known as the Sohare Creek Unit Exploratory Oil Well No. 1-35 is located in the Sohare Creek drainage, a tributary of the Gros Ventre River, Teton County, Wyoming (Exhibit 1-1). The project area is located approximately 45 road miles northeast of Jackson, Wyoming in the SW 1/4 of Section 35, T43N, R112W, 6th principal meridian.

The proposed project involves construction of a 6.0-acre well pad and resident camp site; construction of approximately 3.3 miles of new access road; drilling of a single exploration well; production testing of hydrocarbon bearing formations; producing hydrocarbons from this one exploratory well (if encountered); and reclamation of the drill site, campsite, and access road if drilling is non-productive. The planned drilling depth is 11,050 feet. Amoco proposes to start reconstruction of existing roads and construction of new access road and the drill site by mid summer, 1988. The drilling and well completion activities (if productive) will commence immediately following construction and continue through the fall and winter and are expected to take about 180 days, barring any major drilling difficulties.

1.2 PURPOSE AND NEED FOR ACTION

Amoco Production Company has proposed the Sohare Creek Unit No. 1-35 Exploratory Oil Well to determine if hydrocarbons are present within the Sohare Creek Unit. If hydrocarbons are encountered, production potential from the one well would be evaluated.

Private exploration and development of federal oil and gas leases is an integral part of the Bureau of Land Management's (BLM) oil and gas leasing program under authority of the Mineral Leasing Act of 1920 and the Federal Land Policy and Management Act of 1976. The overall oil and gas leasing program is needed to encourage development of domestic oil and gas reserves to reduce the United States' dependence on foreign energy supplies. Despite decreases in per capita energy consumption since the mid-1970s, the United States continues to rely heavily on foreign energy sources. The U.S. Energy Information Administration (1984) projects that by 1990 the United States will continue to import approximately 38 percent (6.4 million barrels per day) of its domestic petroleum needs and 5 percent (0.8 trillion cubic feet per year) of its domestic natural gas needs.


GRAND
TETON
NATIONAL
PARK
R113W
R112W
R111W
R110W
R109W
T45N
T44N
T43N
T42N
TETON WILDERNESS BOUNDARY
HIGHWAY 26 287
GRAND TETON NATIONAL PARK BOUNDARY
HIGHWAY 89 191
JACKSON HOLE
SOHARE CREEK UNIT BOUNDARY
DRILL SITE 1-35
GROS VENTRE ROAD
SHOSHONE
NATIONAL ELK REFUGE
TO JACKSON, WYOMING 8 MILES SOUTH
GROS VENTRE WILDERNESS BOUNDARY
EXHIBIT 1-1
Amoco Sohare Creek Exploratory Oil Well Project Area Location
0 1 2 3 4 5
Scale in Miles
WYOMING

1.3 ENVIRONMENTAL ANALYSIS PROCESS

The BLM, as authorized by the Council for Environmental Quality (CEQ) and the National Environmental Policy Act (NEPA) directives, analyzes actions involving federal leases as to their impact on the human environment (40 CFR, Parts 1500-1508). The analysis is to determine whether approval of the action would constitute a "major" federal action necessitating preparation of an environmental impact statement (EIS). The analysis uses an accepted process for evaluating and disclosing the potential environmental consequences of the proposed action and alternatives. An environmental assessment (EA) completed in November 1986 documented the analysis and evaluation of the Amoco proposal. Based upon this evaluation of the potential adverse environmental effects and proposed mitigation measures documented in the EA, the Forest Service (FS) and BLM concluded that this proposal may significantly affect the human environment and that an EIS was necessary to answer unresolved issues.

The FS, Bridger-Teton National Forest, Jackson, Wyoming and the BLM, Rock Springs District, Rock Springs, Wyoming are the joint lead agencies responsible for preparation of the EIS. The evaluation of this proposal, including alternatives, was developed through interdisciplinary field review with representatives from Amoco, FS, and BLM. Interdisciplinary participation was provided by a third party contractor, a private consultant, selected by and working under the direction of, and in cooperation with the FS and BLM.

The purpose of the EIS is to provide the decision makers with information upon which to base a final decision that is fully informed and based on factors relevant to the proposal. It also serves as the summary documentation of analysis directed at the proposal and alternatives in order to identify environmental impacts and mitigation measures necessary to address issues.

The decisions to be made during the environmental analysis process regarding the Amoco proposal involve the following:

- A determination of whether the drilling proposal can be conducted in accordance with stipulations contained in lease W-66212 and special stipulations attached to the Sohare Creek Unit Agreement (refer to Appendix B - Lease Stipulations).

- A determination of whether or not the proposal is in conformance with BLM and FS policies, regulations, and approved land management direction pertaining to oil and gas exploration and development activities.

- A determination of whether a location for a drill site and access route exists that would be environmentally suitable,

meet the needs of other resource management activities, and acceptably mitigate surface resource impacts, while honoring Amoco's lease rights.

This EIS is not a Decision Document. It is the result of a process used to document the effects of the proposal and alternatives. The decision regarding the proposal will be documented in a Decision Document signed by the responsible officials. The FS/BLM decision will relate only to lands administered by the FS. Decisions by other jurisdictions to issue or not issue approvals related to this proposal may be aided by the disclosure of impacts available in this analysis.

1.4 LAND STATUS, LEGAL, AND POLICY CONSIDERATIONS

1.4.1 Land Status

The surface area involved with the Amoco proposal is under the administrative jurisdiction of the FS. The mineral estate is under the administrative jurisdiction of the BLM. No other land ownerships within the analysis area are involved with the drilling proposal.

1.4.2 Lease Stipulations

The Amoco Production Company Sohare Creek Unit Exploratory Well No. 1-35 application for permit to drill (APD) is provided for under lease W-66212, issued by the BLM on March 1, 1979. This lease contains the following stipulations:

- Stipulations For Lands Under Jurisdiction of Department of Agriculture - Form 3109-3. (Requires compliance with Department of Agriculture rules and regulations on National Forest lands.)

- Surface Disturbance Stipulation - Form 3109-5. (Requires project approval by the Surface Management agency; (Forest Service) and the District Manager (Bureau of Land Management). This stipulation also requires an environmental analysis of impacts.)

- Surface Occupancy Stipulation - Supplement to Form 3109-3. (Provides protection for existing roads, trails, streams, improvements, and cultural resources by establishing limiting distances for site occupancy.) The following areas will be excluded from surface occupancy unless specifically approved in the operating plan:

    1. Areas within 500 feet on either side of the centerline of any and all roads and/or highways within the lease area.

2. Areas within 200 feet on either side of the centerline of any and all designated trails within the lease area.

3. Areas within 500 feet of the normal high waterline of any and all streams, lakes, ponds, and reservoirs located within the lease area.

4. Areas within 400 feet of any and all springs within the lease area.

5. Areas within 400 feet of any improvements either owned, permitted, leased, or otherwise authorized by the surface management agency.

Also, this stipulation prohibits entrance onto the lease area and any site disturbing activities until either: (a) an inventory of archeological, paleontological, and historical sites is made by the surface management agency or its designated representative, or (b) the lessee has made or caused to be made an inventory of all archeological, paleontological, and historic sites in those areas of the lease subject to development, occupancy, or surface disturbance.

- Special Stipulation - (Requires a plan of construction by the proponent prior to any activity which involves removal of vegetation. Such approval may be conditioned on reasonable requirements to prevent erosion, water pollution, or damage to surface resources and to provide for restoration of the surface.)

- Special Wildlife Habitat Stipulation - (Requires consultation between the proponent, the District Manager (BLM), the Forest Supervisor (Forest Service), and the Wyoming Game and Fish Department regarding critical habitat for certain wildlife species. Of concern on lease W-66212 are elk calving, elk and moose forage areas, and grizzly bear.)

- Jackson Hole Area Oil and Gas Lease Stipulation - (Requires a Unit Plan and a Designation of Unit Operator.)

1.4.3 Unit Stipulations

Amoco Production Company, as required by terms contained in the Jackson Hole Area Oil and Gas Lease Stipulation, has formed a Federal Unit known as the Sohare Creek Unit. This unit was approved by the BLM on January 31, 1986.

Operation of this 18,430-acre tract of land is authorized by a Unit Agreement between lease holders within the Unit Area. According to terms of the Unit Agreement, Amoco is designated the

Unit Operator. Assignment of Unit Operator implies that Amoco consents to accept the duties and obligations for discovery, development, and protection of gas and/or oil reserves within the Unit Area, should they occur.

Special stipulations prepared by the FS are made a part of the approved Unit Agreement. These additional stipulations provide measures where necessary to protect resource values not specifically addressed in the lease stipulations. These special Unit Stipulations and their location within the Unit Area are shown in Appendix B - Lease/Unit Stipulations.

1.4.4 Field Development Considerations

During the public scoping process, an issue was identified regarding a need to study a range of "field development" scenarios in the EIS. This study should attempt to analyze the environmental effects which would follow if Amoco discovered oil and/or gas and proceeded with field development. In addition, it was suggested that a field development plan be prepared and that it include a projection, based on best available geologic information, of the extent to which field development may occur, including drill site locations and spacing, roads, power and pipeline corridors, treatment facilities, and eventual means of transportation to market.

The scope of this EIS includes the action of drilling a single well; production from that well; and estimates of what might result if a find occurs relative to that well. Regulation 40 CFR, Part 1508.25(a)(1) states that connected actions (which means that the actions are closely related and therefore should be discussed in the same impact statement) are described as being connected if they: 1) automatically trigger other actions which may require environmental impact statements; 2) cannot or will not proceed unless other actions are taken previously or simultaneously; and 3) are interdependent parts of a larger action and depend on the larger action for their justification. The proposed drilling of the exploratory oil well and the production of hydrocarbons from this one well are considered connected actions, and therefore, both will be included within the scope of this EIS.

The rationale for determining the scope of this EIS is explained as follows:

- Field development is not part of the proposed action and a decision concerning future development will be made by either the BLM or the FS at a future time. None of the alternatives considered in this EIS further commit the BLM or the FS to any future decision regarding field development.

- The scope of the EIS is consistent with the NEPA regulations in that the proposed action, in relation to field development, is not a "connected action." That is, it (the proposed action) would not "automatically trigger" other actions (i.e., field development) that may require an EIS; it is not dependent upon other actions occurring previous to or simultaneously with it before it can proceed; and it is not dependent upon a larger action for its justification. The proposed action is not a "cumulative action." That is, it would not occur simultaneously with other proposed actions (e.g., field development, timber sales, etc.) having cumulatively significant impacts; and finally, "similar actions" are not "...reasonably foreseeable," particularly in light of the fact that "...no commercial production has come from any of the 44 wells so far drilled in Teton County" (Oil and Gas in Teton County: A Report of the Ad Hoc Committee 1987).

  If the Sohare Creek Well is drilled and commercial quantities of oil or gas are discovered, then the BLM and FS regulations and the terms of the Sohare Creek Unit Agreement require that, if Amoco desires to proceed with further development, a conceptual field development plan be prepared. An environmental analysis (including consultation with the USFWS) would then be completed on all aspects of field development before any further action can be taken on additional APDs. A discussion of field development is included in Appendix A. It covers the probability of discovery, the stages of single well development, what field development may entail, and the technical and environmental review process.

  More detailed information on possible field development, may be found in the Teton County Ad Hoc Committee's report on oil and gas in Teton County. The FS and BLM participated as members of the committee and both agencies consider this report to represent the best assessment of current knowledge and information available. The Ad Hoc Committee was appointed by the Teton County Commissioners as the result of intensified controversy over the perceived conflicts between oil and gas development and values of scenery, wildlife, and recreation in Teton County. The committee was given two charges. "First, to determine, if possible, the extent to which oil and gas development is appropriate in Teton County and, second, to obtain factual descriptions of such development and its impact and to provide that information to the public." The committee's report was published in February 1987. Over 6,000 copies of that report were distributed by the two newspapers in Jackson, Wyoming; The Jackson Hole Guide and the Jackson Hole News.

1.5 AUTHORIZING ACTIONS

The federal, state, county, and local authorizing (permitting) actions required to implement the Amoco exploratory drilling proposal would generally be the same regardless of the access alternative selected. These actions are listed in Table 1-1.

1.6 ISSUES AND CONCERNS

Public issues and comments regarding the Amoco proposal were solicited for incorporation into this EIS through the scoping process. A Scoping Statement that described the action to be analyzed; identified preliminary land and resource management issues, concerns and opportunities; and outlined timing needs for public involvement was prepared and submitted to the public (January 26, 1987).

Social and environmental issues and concerns of local importance identified for the Amoco proposal are as follows:

1. The proposed northern access alternative is located in Grizzly Bear Management Situation 1 and 2 Habitat. There are concerns regarding the cumulative effects of use of this road and the drilling action on grizzly bear habitat when considered with on-going activities and other proposals in the affected area.

2. Elk migration occurs annually through the project area. A management objective for the Jackson Hole elk herd is to restore historical distribution of migration within the project area. The drilling proposal and south access route may disrupt use of historic migration routes.

3. There are management concerns regarding possible impacts to big game winter range in the Gros Ventre River drainage.

4. There are concerns regarding possible impacts to elk calving areas in the vicinity of Gunsight Pass.

5. Concerns exist regarding the impact the drilling proposal could have on commercial outfitter/guide operations in the Cottonwood Creek and Kettle Creek drainages.

6. There are Wyoming Recreation Commission groomed and maintained snowmobile trails in the project area, and also commercial snowmobiling operations. There are concerns regarding winter drilling and impacts to the established snowmobiling activities.

7. Dispersed recreation opportunities within the project area, primarily big game hunting during the fall months, may be reduced as a result of drilling activities.

8. Drilling of this well and possible subsequent full field development in the Sohare Creek Unit may disrupt significant scenic and wildlife resources important to the tourist-based economy of Jackson Hole and to the welfare of the Nation's public.

9. Possible adverse impacts to the biological and aesthetic values of the Greater Yellowstone Ecosystem could result from field development.

10. New road construction would be required to access the drilling proposal in an area currently without roads.

11. There are unstable soils within the project area. The potential for an increase in erosion and stream sedimentation exists with construction activities on these unstable soils.

12. Road construction activities are proposed on sideslopes over 40 percent. There is potential conflict with Unit Stipulations regarding site occupancy on slopes in excess of 40 percent.

13. Successful reclamation may be difficult to achieve on steep, unstable slopes.

14. Concern exists for the cumulative impacts of the drilling proposal relative to other land and resource use activities in the area.

15. The drilling proposal lies within a cattle grazing allotment. Disruption of herd management activities and some loss of suitable range forage may occur as a result of the drilling action.

16. Future management of any new access roads constructed to access the drill site in the event drilling is productive could adversely affect other uses.

17. The drilling proposal may be inconsistent with the proposed Bridger-Teton National Forest Land and Resource Management Plan. (Draft issued for public review, October 1986.)

18. Helicopter access and support activities (including drill rig mobilization) should be considered a valid alternative in lieu of new road construction to the drill site.

19. The project area and adjacent lands are classified as a zone 3 seismic risk area. Consideration of seismic risk (earthquakes) should be taken into account in the drilling program, particularly if there is a chance of encountering sour gas (hydrogen sulfide).

TABLE 1-1

FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS

Agency	Nature of Action
DEPARTMENT OF INTERIOR	
Bureau of Land Management (Rock Springs District)	Approval of Application for Permit to Drill (APD), hydrogen sulfide contingency plan, wastewater disposal, Sundry Notices.
	Approval to vent or flare gas.
	Approval to dispose of produced water.
	Unit Area Agreement approval.
	Grant approval of access road survey and design for new construction and prescribed reconstruction of existing roads inside the Unit Area.
U.S. Fish and Wildlife Service	Review impact on threatened or edangered species of fish, wildlife, and plants.
DEPARTMENT OF AGRICULTURE	
U.S. Forest Service (Bridger-Teton National Forest)	Issue special use permits for constructing rights-of-ways on Forest Service surface outside Teton National Forest unit boundaries.
	Grant approval of access road survey and design (new construction and prescribed reconstruction of existing roads outside the Unit Area).
	Issue antiquities permits and permit to excavate and remove archeological resources on National Forest System Lands.
	Issue timber sale contracts for merchantable timber involved with construction.

Table 1-1 Continued

Agency	Nature of Action
ENVIRONMENTAL PROTECTION AGENCY	Issue Resource Conservation and Recovery Permit for treatment, storage, or disposal of hazardous waste.
	Register generators of hazardous waste.
DEPARTMENT OF THE ARMY U.S. Army Corps of Engineers	Issue (Section 404) Individual permit(s) for placement of dredged or fill material in waters of the United States or their adjacent wetlands.
WYOMING OIL AND GAS CONSERVATION COMMISSION	Primary authority for drilling on state and privately held mineral resources.
	Authority to allow or prohibit flaring or venting of gas.
	Gas injection well permits.
	Regulate drilling and plugging of wells.
	Directional drilling.
	Rules and regulations governing drilling units.
	Permits to drill and blowout prevention.
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY Water Quality Division	Approval of sewage treatment facilities (ground water pollution control permit).
	Section 401 Certification for stream crossings.
	Approval of culinary water supply for resident camp.

Table 1-1 - Continued

Agency	Nature of Action
Water Quality Division	Approval of wastewater disposal.
	Temporary permit to use water.
WYOMING STATE ENGINEER'S OFFICE	
WYOMING STATE HISTORIC PRESERVATION OFFICE	Consultation for cultural clearance.
WYOMING STATE HIGHWAY DEPARTMENT	Encroachment permits.

1.7 OPPORTUNITIES

Opportunities that may be derived from the drilling proposal include:

1. The drilling proposal would provide Amoco the opportunity to evaluate lands within the Sohare Creek Unit for hydrocarbon potential.

2. The potential for improving existing FS transportation system roads within the project area through improved maintenance and additional surfacing or through providing a new system road for use in future land management projects in a previously inaccessible area.

3. The drilling proposal and related support activities may provide economic benefit to nearby communities.

CHAPTER 2

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

Alternative Selection Process

Amoco Production Company filed an Application for Permit to Drill (APD) with the Bureau of Land Management (BLM) (October 17, 1985) to drill an exploratory oil well in the Sohare Creek drainage in the center of the SW 1/4 of Section 2, T42N, R112W. On October 24th and 25th, 1985, an interdisciplinary team field review of the drill site, potentially suitable alternate sites, and access alternatives was conducted by representatives of the Forest Service (FS), the BLM, Amoco Production Company, and the consultant interdisciplinary team.

Following their APD submission and the interdisciplinary team field review in October 1985, Amoco completed and evaluated additional seismograph testing to substantiate the well control data they were using (Exxon Company, U.S.A. geologic data for the well in Section 34, T43N, R112W). This resulted in a change in Amoco's preferred well bottom hole location from Section 2, T42N, R112W to the SE 1/4 SE 1/4 of Section 34, T43N, R112W. However, a suitable site for the construction of a drill pad was not located due to steep slopes in this area. Instead, a suitable drill site was identified in the center of the SW 1/4 of Section 35, T43N, R112W. This location would allow adequate attainment of the preferred bottom hole location in the SE 1/4 SE 1/4 of Section 34 through directional drilling techniques (see Exhibit 1-1).

The drill site location in Section 35 was analyzed by the interdisciplinary team during the October field review as a possible drill site alternative. After the determination by Amoco that Section 35 was a viable location from which they could reach the bottom hole of the well, additional soils and hydrologic information was collected by the interdisciplinary team. On February 6 and 7, 1986, three observation bore holes (4 inches in diameter and approximately 30 feet deep) were drilled on the site so that sub-surface soil and water characteristics could be evaluated.

An environmental assessment (EA) was completed for the drilling proposal (December 1986). Based upon the evaluation of the potential adverse environmental effects and the proposed mitigation measures documented in the EA, the FS and BLM concluded that the Amoco proposal may significantly affect the human environment and therefore, an environmental impact statement (EIS) was required. The EIS analysis process commenced in January 1987. The Sohare Creek Unit proposal is not the first exploratory drilling attempt within the analysis area. As previously mentioned, Exxon

drilled an exploratory well in NE 1/4 NW 1/4 of Section 34, T43N, R112W in 1980 and 1981 as shown on Exhibit 2-1. Hydrocarbons were encountered with the test well but apparently not in economically producible quantities. The well was plugged and abandoned in 1982. Two other exploratory wells were drilled on the southern end of the analysis area in the 1950s. Placid Oil drilled a test well in 1953, and Tennessee Oil and Gas Company (Tenneco) drilled one in 1957 (Exhibit 2-1). Both of these attempts were unsuccessful and were plugged and abandoned.

2.2 DESCRIPTION OF ALTERNATIVES

2.2.1 Project Area

The Sohare Creek Unit Area is located about 24 air miles northeast of Jackson, Wyoming as shown on Exhibit 1-1, about 12 air miles south of U.S. Highway 26-287, and about 7 air miles north of the Gros Ventre River - Cottonwood Creek confluence as shown on Exhibit 2-1.

Amoco's drilling proposal specifically involves construction of a 6.0-acre well pad and resident camp site; construction of approximately 3.3 miles of new access road in the Kettle Creek and Sohare Creek drainages; drilling of a single exploration well; production testing of hydrocarbon bearing formations; producing hydrocarbons from this one well (if producible hydrocarbons are encountered); and reclamation of the drill site, camp site, and access road if drilling is non-productive. Alternatives to the Amoco proposal include alternate access roads to the proposed drill site; an alternate means of access other than roading (helicopter support and mobilization); and the alternative of "No Action". The proposed action and alternatives are shown on Exhibit 2-1 and are more specifically described as follows:

2.2.2 Alternative A (Proposed Action) - Drill well from site staked in the SW1/4 of Section 35, T43N, R112W, using a northern (Kettle Creek) access route.

Alternative A is Amoco's preferred drill site and access route. The drill site is located in the upper portion of the Sohare Creek watershed at a valley bottom position. The drill site is covered by spruce-fir vegetation community over about one-third of the drill site area, with upland meadow covering the other half of the site. Topography of the drill site area is characterized as being uniform with mild slopes of approximately 12 percent, and with an east-northeast aspect. A resident campsite to house approximately 30 drilling-related personnel at the drill site is planned.

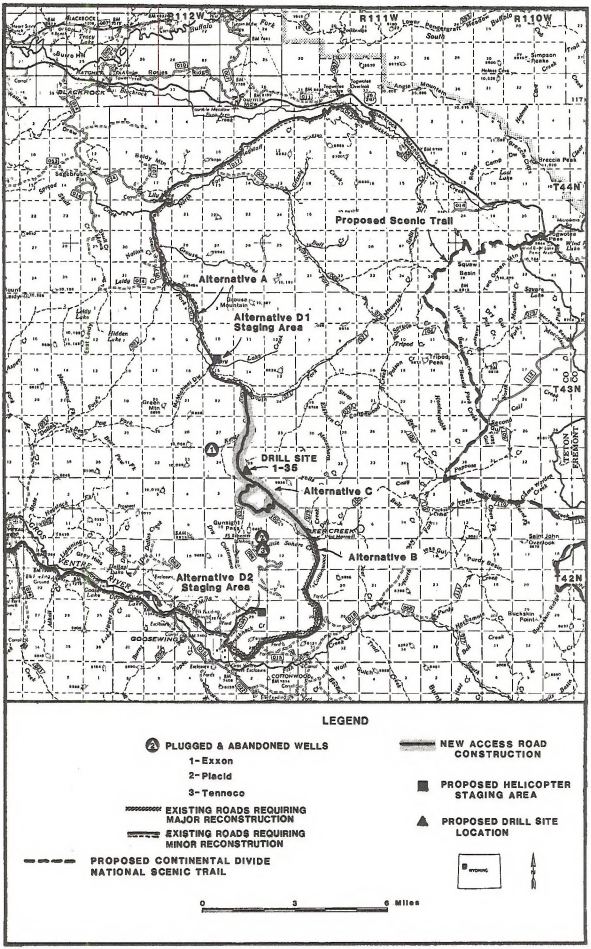


EXHIBIT 2-1. Amoco's Sohare Creek Exploratory Oil Well-Location of the Proposed Action and Alternatives.

Access to Alternative A would be provided by the existing Flagstaff and Leidy Creek Roads from U.S. Highway 26-287 (Exhibit 2-1). New construction would begin at the intersection of the existing road on the South Fork of Spread Creek with the previously reclaimed roadway in Kettle Creek. (The segment of reclaimed roadway was utilized to access the Exxon drill site in Section 34 in Kettle Creek. This road segment is further described in Chapter 3.) The new road proposal would follow the alignment used to access the abandoned Exxon site to a point on a south drainage of Kettle Creek. From there, the proposed access would proceed south over the hydrographic divide between Kettle Creek and Sohare Creek to the proposed drill site. Total length of new road construction would be approximately 3.3 miles. The total disturbed area, including the drill site and camp site, would be approximately 26.0 acres. Construction activities are described as follows:

Wellpad Construction - The wellpad would be constructed from native materials located at the site and would occupy an area approximately 340 feet by 425 feet or about 3.3 acres. Exhibit 2-2 shows the approximate layout of the wellpad and campsite and associated facilities. The wellpad would be designed so that construction materials would balance (i.e., cut and fill material would be about the same quantity), while attempting to minimize the total disturbed area. All available topsoil suitable for reclamation would be stripped from the wellpad area and stored adjacent to the wellpad prior to start of actual wellpad construction. Cut slopes would be designed in a manner that would allow for retention of topsoil during reclamation and subsequent re-establishment of vegetation.

Other features of the wellpad would include construction of a reserve pit to temporarily store drilling fluids, cuttings, and water produced during drilling. To prevent seepage, the reserve pit would be lined with native clay material or an impermeable membrane liner. Surface water drainage controls on, or adjacent to the well site such as berms, sediment collection areas, diversion ditches and erosion stops, and prompt revegetation would be required to control site erosion and off-site sedimentation. Locations of these measures would be included in the design plan for the well site. A septic system, approved by the Wyoming Department of Environmental Quality (DEQ), would be installed on location for use in conjunction with the resident camp site and service trailers on the site. Water, for use in conjunction with drilling and at the camp site, would be obtained from a water well drilled on, or adjacent to, the wellpad. Wellpad construction and related facilities would require approximately 10 days to complete. Prior to stripping of topsoil, all vegetation would be removed from the wellpad area. Commercial timber located on the site would be cut to merchantability specifications, sold to Amoco, and hauled off-site. After topsoil stripping operations are complete, construction of the wellpad

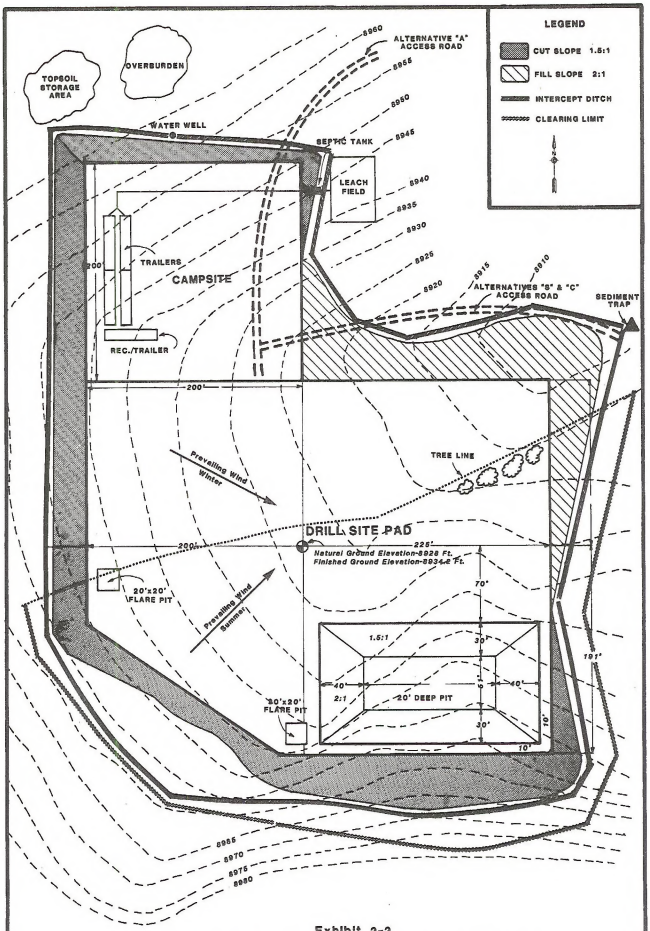


Exhibit 2-2.
Schematic of Proposed Drill Site and Worker Camp Layout.

would begin. Construction practices would involve use of standard earthwork construction equipment. A typical schematic of drilling layout is shown on Exhibit 2-3.

Access Road Construction - All access road construction would be in accordance with an access road design plan submitted by Amoco to the FS and BLM for approval. The design plan would utilize the Oil and Gas Roading Guidelines for Region 4 (FS). These roading guidelines set forth procedures for oil and gas exploration and development roads on National Forest System lands.

The primary road access utilized by Amoco would be a State Highway used in conjunction with FS collector or local roads. FS "collector roads" in the project area are described as single-lane roads with a 14-foot travelway and intervisible turnouts or double-lane roads with a 24-foot travelway. These roads serve smaller land areas and are usually connected to a Forest arterial road or public highway. They collect traffic from Forest local roads or terminal facilities. Collector roads are the existing roads in the project area and would require some upgrading to become totally serviceable for the proposed drilling action. "Local roads" are described as single-lane roads with a 14-foot wide travelway and intervisible turnouts. These roads connect terminal facilities with Forest collector or Forest arterial roads, or public highways. In the project area, proposed new road construction would be considered "local roads."

Following completion and approval of the access road design plans, the access road would be construction staked on the ground in accordance with the engineering standards contained in the Region 4 Roading Guidelines. Construction staking consists of determining finished site elevations, cut and fill slopes and their respective catch points, drainage, balanced earthwork, and other necessary construction features such as stabilization fabric locations. Construction staking will be approved by the FS prior to any earth disturbing activities.

With completion and approval of construction staking, access road construction activities would begin. The first step involved with access road construction is right-of-way clearing. The access road right-of-way must first be cleared of all brush and trees before actual construction of the road begins. Merchantable timber would be disposed of as directed by the FS. Disposal methods may consist of purchase and subsequent removal from Forest lands of the timber by Amoco, decking in designated areas, chipping or burning, or other approved methods compatible with the particular situation. Logging slash and debris would be disposed of by burial or burning at designated sites along the access road right-of-way.

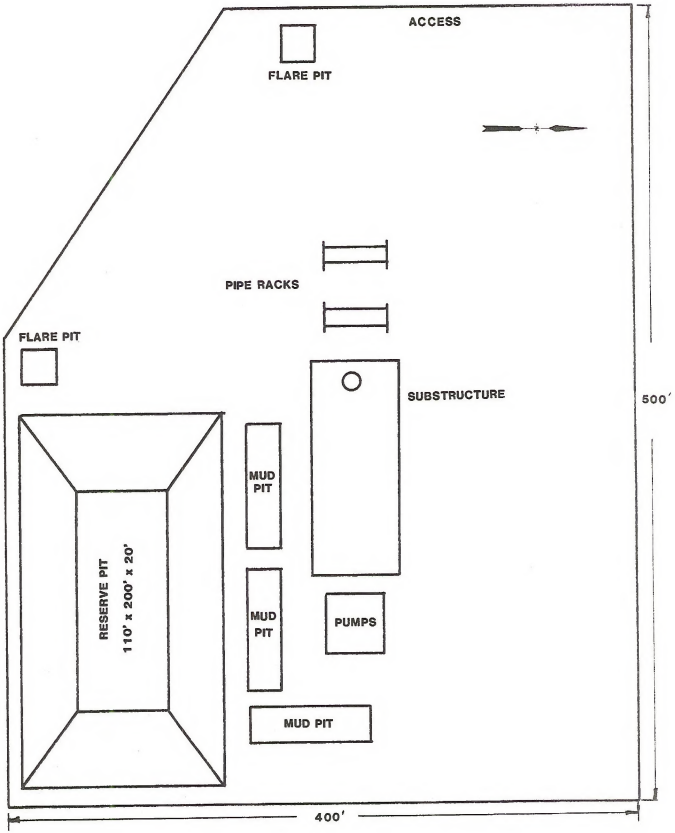


Exhibit 2-3.

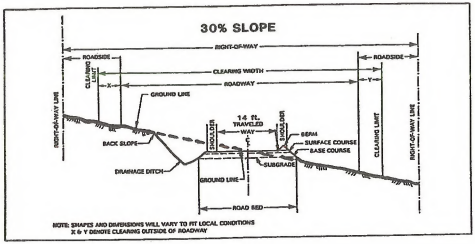
TYPICAL DRILL SITE LAYOUT

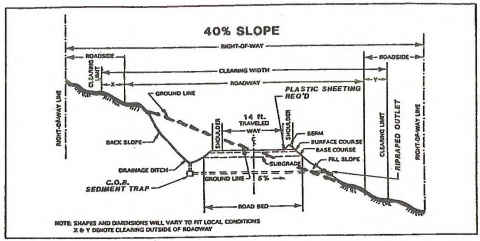
After clearing has been completed, tree stumps would be grubbed and topsoil with grass, forbs, and small shrubs would be stripped from all areas along the right-of-way where surface disturbance is necessary and stockpiled in a designated area or areas to prevent loss from erosion or contamination with other excavated materials. All topsoil would be removed in a separate layer from other subsoil materials. The depth of the topsoil materials to be removed and stockpiled would be specified by the FS, but would generally include the "A", or uppermost soil horizon.

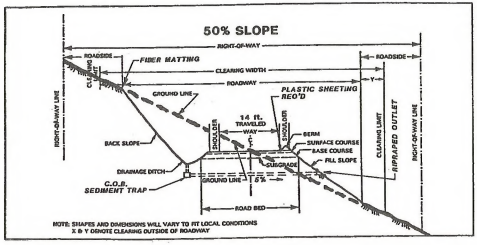
Construction of the access road profile would begin upon completion of all clearing and topsoil stripping operations. Except in areas of steep slopes (>40 percent), construction equipment and techniques utilized by Amoco would be by standard cut-and-fill construction methods and construction machinery such as motor scrapers and crawler tractors, graders, and motor scrapers. To assure that supplies and equipment can be transported to the drill site during all-weather conditions, Amoco plans to gravel the new access road and segments of the existing access roads needing additional surfacing. Gravel sources, amounts, and locations for application would be shown on the approved access road design plan.

Sections along the proposed access road right-of-way have limiting terrain factors that would preclude some conventional construction techniques. A Geotechnical Road Feasibility Evaluation and Report will be completed to identify areas requiring special design and construction measures and to present a detailed description of how these measures would be applied. These limiting factors and construction methods that Amoco would utilize to solve the construction problems are discussed as follows:

- **Access Road Construction across slopes in excess of 40 percent.** Road construction across sideslopes in excess of 40 percent would require a waiver by the BLM and FS of a Unit Agreement Stipulation. For a waiver to be granted, Amoco would be required to demonstrate the feasibility of constructing roads across sideslopes in excess of 40 percent. Slope gradients in excess of 40 percent tend to correspond to a threshold point at which cut and fill slopes become expansive, resulting in a larger scar with greater difficulty in successfully reclaiming the site, instability due to a greater mass of earth material being undercut resulting in increased landslide potential, and increased difficulty in returning cut and fill slopes to their approximate original contour. Exhibit 2-4 and 2-5 illustrate the relationship between slope gradient and cumulative length of cut and fill.







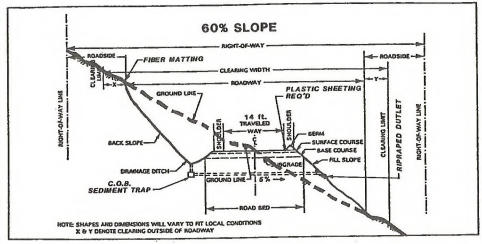


Exhibit 2-4.

RELATIONSHIP OF HILL SLOPE GRADIENT TO CUT AND FILL AREA AND LENGTH ASSOCIATED WITH ACCESS ROAD CONSTRUCTION

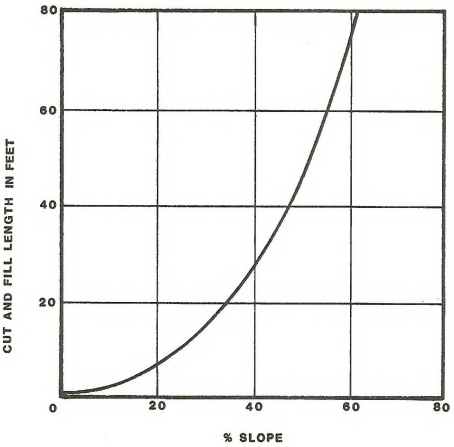


EXHIBIT 2-5.

RELATIONSHIP OF CUT AND FILL LENGTH TO HILL SLOPE GRADIENT ASSUMING 1:1 CUT RATIO

A Geotechnical Road Feasibility Evaluation and Report prepared by Amoco or Amoco's designated consultant will be required for the BLM and FS to grant an exception or waiver of the applicable stipulation. The geotechnical evaluation and report shall be completed by a qualified professional(s) experienced with road construction in mountainous terrain. The evaluation and report must demonstrate whether road construction is feasible; the alignment required in order for it to be feasible; the construction methods and techniques which must be employed; any special measures necessary to avoid or prevent stream sedimentation or landslides; and requirements for successful reclamation.

Amoco would use minor routing variations to avoid as much of these steep slopes as possible during access road routing and design. Where these steep areas cannot be avoided, the following procedures would be implemented: binwalls, gabions, reinforcement walls, or toeslope berms would be constructed to control the length of fill slopes to maintain feasible reclamation. Drainage control and retention structures such as crib walls or gravity walls made of rock, erosion control fabric, or engineering fabric would be used to stabilize and control cut. Partial or full bench construction with end hauling and stockpiling of excavated material, concrete or timber crib walls, or other retaining structures built on hillslope would be used to support road prism and minimize length of fill slope. Viaducts would be used on short segments of steep hillslopes. Reclamation would include replacing fill, removing structures, contemporaneous "backout" regrading to approximate original contour, topsoil replacement, erosion control structures such as waterbars, seedbed preparation, seeding and mulching, matting and netting staked in place.

- **Access road construction across wet areas and adjacent to live streams.** Where possible, Amoco would implement minor route realignment to avoid wet areas. If not possible, Amoco would place the road on the gentler part of the slope across wet areas, and minimize the cuts and fills. If additional mitigative measures are needed to reduce impacts to the wet areas, Amoco would use stabilization fabric, coarse rock fill across the wet area to construct a french drain, and drainage pipe to dewater these areas. Where road construction in the stream environment is necessary, Amoco would limit the areal extent of site disturbance. Where possible, a 100-foot wide buffer strip of natural vegetation would be left in place between all construction activities and stream channels. Where a 100-foot vegetative strip is not present, Amoco would utilize sediment control and

drainage structures that are compatible with the particular sediment control problem (e.g., straw bales and sediment fences, and binwalls or gabions between the disturbed areas and the stream channel).

- **Stream Crossings.** Bridges would be installed for stream crossings instead of culverts to reduce the potential for impacting the stream environment due to road fill erosion, stream sedimentation, and flooding.

- **Reclamation/Site Stabilization.** In the event drilling is non-productive, all disturbed areas, including the drill site, new access road, and resident camp site would be reclaimed to the landform that existed prior to construction. Reclamation and site stabilization techniques used during reclamation would be as specified by the FS and BLM in a comprehensive reclamation plan to be submitted by Amoco prior to the start of construction. If drilling is productive, all access roads to the well site would remain in place for well servicing activities, such as crude oil hauling and maintenance of improvements. Partial reclamation would be completed on roadsides and portions of the well site not utilized during production phase and complete reclamation of the resident camp site would be accomplished.

Exploratory Drilling - Once the drill pad and access road construction and reconstruction activities were completed, Amoco would begin the exploratory drilling phase of the project. A drilling rig would be transported to the wellpad by truck and erected on-site. The Amoco proposal would require transport of approximately 200 truckloads of drilling-related equipment and materials to facilitate the drilling operation. Total rig-up activities and installation of the resident camp site would take from 7 to 10 days to complete. The wellpad layout for the drilling period would be similar to that shown on Exhibit 2.2. The drilling and well completion activities (if needed) are expected to take about 180 days barring any major drilling difficulties.

Amoco proposes to drill the exploration well to a depth of 11,050 feet to test the Madison Formation. Intermediate drilling objectives include the Nugget, Phosphoria, and Tensleep formations. As drilling commences and the wellbore is progressively deepened, steel casing would be installed in the wellbore and cemented in place to 1) prevent the sides of the wellbore from collapsing; 2) protect against abnormal pressure conditions that may exist at greater depths; and 3) protect freshwater and other mineral bearing formations. Potential hydrocarbon producing formations would be evaluated during the drilling program by utilizing various well testing methods and techniques.

Amoco has proposed a fall-winter drilling season with drilling activities ending around the end of March. Drilling operations would be conducted continuously 24 hours a day, 7 days a week during the drilling program.

Production Operations - Initially, if hydrocarbons were encountered, production from the well would be stored on location and trucked off at the rate of approximately three tanker trucks per day. Production operations, as depicted in Exhibit 2-6, would require use and maintenance of the access road on a year-long basis. Maintenance during the summer and early fall months would be typical of graveled road maintenance operations in the area. Maintenance during the winter months would be relative to the amount of production encountered. If production were minimal, the well could be shut-in during the winter and checked by snowmobile or snow cat. Should production be sufficient to justify continued winter operation, winter maintenance would include blading and blowing snow from the access road with escape openings for wildlife. Depending on the road use limitations, the well may be shut-in during spring thaw.

Site Restoration and Abandonment - As previously stated, Amoco proposes to completely reclaim the drill site, worker campsite, and new access road in the event drilling is non-productive; reclaim portions of the wellpad not utilized during the production phase; and totally reclaim the resident camp site if drilling is productive. Reclamation procedures to be used would be as specified in a comprehensive reclamation plan to be submitted to the FS by Amoco for approval prior to the start of construction. Briefly described, reclamation would include 1) complete cleanup of the drill site and campsite area, including the removal of drilling wastes to an approved offsite disposal site; 2) restoration of the drill site and camp site to the ground contour that existed prior to construction; 3) replacement of topsoil over all disturbed areas; and 4) seeding of reclaimed areas with the seed mixture prescribed in the approved site reclamation plan. The water well drilled on location would likely be abandoned unless the FS requested that it be left in place for other uses, such as a livestock or wildlife watering facility. Reclamation procedures followed in reclaiming the drill site and camp site will also be utilized in reclaiming the access road. Access road reclamation would begin at the present road closure point in the South Fork of Spread Creek drainage and follow the road alignment up to the drill site location. If commercial quantities of oil are discovered, the well site and access road would not be reclaimed as described above. The reserve pit and segments of the wellpad not needed for production would be stabilized and revegetated. The reserve pit would be backfilled with excess fill material resulting from wellpad construction. The wellhead would be left in place and the remaining segment of wellpad fenced for security purposes. The access road to the wellpad and production facilities would remain in place for

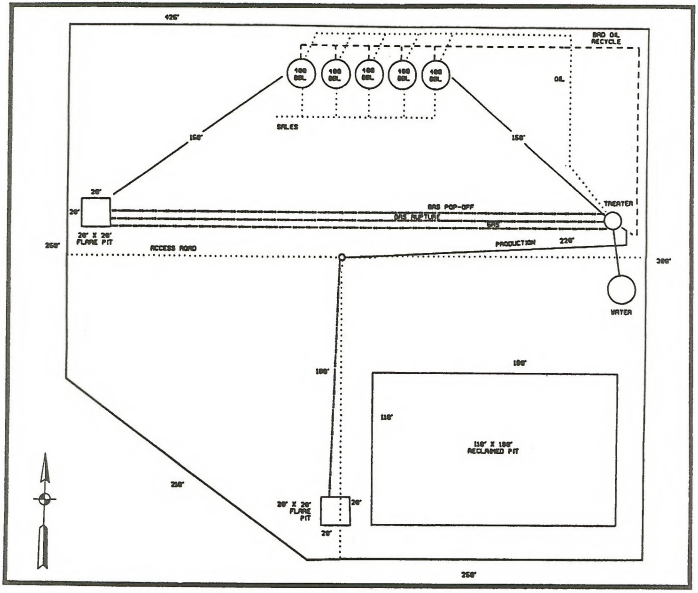


Exhibit 2-6.

SCHEMATIC OF PROPOSED PRODUCTION FACILITIES.

maintenance and production development purposes, and all road cuts and fills would be stabilized, seeded, and revegetated.

Alternative A has lease/unit stipulations limiting occupancy on segments of land within the Sohare Creek Unit boundary. Lease or unit stipulations requiring written waiver by the FS/BLM or other analysis/evaluation needed prior to implementation of Alternative A are as follows:

Sohare Creek Unit Stipulations:

- Limited surface occupancy is authorized on lands specified by the FS that include 1) elk migration, late fall; 2) elk and moose winter range, December 1 to May 1; 3) elk calving, May 15 to June 30; 4) elk and antelope summer range, summer months; and 5) unstable soils, yearlong.

- No surface occupancy on technically unsuitable soils except for certain limited uses as permitted in writing by an authorized officer of the surface management agency.

- No occupancy or other surface disturbance allowed on slopes in excess of 40 percent unless the proponent can demonstrate through a detailed plan that satisfactory construction, operation, maintenance, and rehabilitation of roads traversing these slopes is feasible. Approval from the District Manager of the BLM, with concurrence of the authorized officer of the FS would be required before this stipulation is waived.

- Unit stipulation requires that an acceptable report (biological evaluation) be submitted to the FS identifying the anticipated effects of the proposed action on endangered or threatened species or their habitat.

Lease Stipulations:

- Stipulations on Federal Form 3109-3 specify no surface occupancy within 500 feet of the normal high waterline of any and all streams, lakes, ponds, and reservoirs and 400 feet of all springs and improvements located within the lease area; and no surface occupancy within 200 feet on either side of the centerline of any and all designated trails within the lease area without written waiver by the BLM.

- Special wildlife habitat stipulations applicable to the lease area specify that prior to entry onto the leasehold, the operator will jointly discuss the proposed activities with the Area Oil and Gas Supervisor, the

Forest Supervisor, and the Wyoming Game and Fish Department. Critical habitat of paramount concern on the lease area includes elk calving, elk and moose forage area, and grizzly bear. Additional measures may be required to protect these species and habitat features.

2.2.3 Alternative B - Drill well from Alternative A site using a southern (Sohare Creek) access route.

Alternative B would utilize the drill site and resident campsite described under Alternative A. Clearing, construction, drilling operations and procedures, production operations and reclamation and abandonment procedures would be the same as described under Alternative A.

Alternative B access to the drill site location would begin from the existing U.S. Highway 89-191 north from Jackson, Wyoming, the Gros Ventre Road from the Gros Ventre Junction, and the Cottonwood Creek Road from its junction with the Gros Ventre Road. New road construction would begin at the end of the Cottonwood Creek Road near the confluence of Sohare Creek and Cottonwood Creek. The section of new access road would proceed northwest along Sohare Creek as shown on Exhibit 2-1. Total length of new access road construction would be about 6.0 miles. Heavy reconstruction of 7.2 miles of the Cottonwood Creek Road would be required from near the Goose Wing Ranch to the road ending. A bridge over the Gros Ventre River that is involved in this alternative has been damaged through prior use and would require improvement to support heavy drilling traffic. In addition, 14.2 miles of paved road along the Gros Ventre River are also involved with the Alternative B access route.

Lease or unit stipulations requiring written waiver by the FS/BLM or other analysis/evaluation needed prior to implementation of Alternative B are as follows:

Sohare Creek Unit Stipulations:

- Limited surface occupancy is authorized on lands specified by the FS that include 1) elk migration, late fall; 2; elk and moose winter range, December 1 to May 1; 3) elk calving, May 15 to June 30; 4) elk and antelope summer range, summer months; and 5) unstable soils, yearlong.

- No surface occupancy on technically unsuitable soils except for certain limited uses as permitted in writing by an authorized officer of the surface management agency.

- No occupancy or other surface disturbance allowed on slopes in excess of 40 percent unless the proponent can demonstrate through a detailed plan that satisfactory construction, operation, maintenance, and rehabilitation of roads traversing these slopes is feasible. Approval from the District Manager of the BLM, with concurrence of the authorized officer of the FS would be required before this stipulation is waived.

- Unit stipulation requires that an acceptable report (biological evaluation) be submitted to the FS identifying the anticipated effects of the proposed action on endangered or threatened species or their habitat.

Lease Stipulations:

- Stipulations on Federal Form 3109-3 specify no surface occupancy within 500 feet of the normal high waterline of any and all streams, lakes, ponds, and reservoirs, and 400 feet from all springs and improvements located within the lease area; and no surface occupancy within 200 feet on either side of the centerline of any and all designated trails within the lease area without written waiver by the BLM.

2.2.4 Alternative C - Drill well from Alternative A site using a modified south (Sohare Creek) access route.

The Sohare Creek modified access route (Alternative C) would use the same drill site location as Alternative A, and the same access route as Alternative B from U.S. Highway 89-191 to the second crossing of Sohare Creek. Clearing, construction, drilling operations and procedures, and production operations would be the same as described under Alternative A. Reclamation and abandonment procedures would be the same as described under Alternative A, with some variations occurring due to the different location of the access road. From the second crossing of Sohare Creek, the route continues directly up the Sohare Creek drainage on the west side of the creek to the drill site, a distance of 1.7 miles as shown on Exhibit 2-1. This route alternative was not evaluated in the project EA completed in December 1986. Rather, Alternative C is the third roading alternative identified during internal agency review of the proposed action, and was added to the environmental analysis as an alternative because it involved less total miles of new road construction to access the drill site than Alternative B (Table 2-3).

Lease or unit stipulations requiring written waiver by the FS/BLM or other analysis/evaluation needed prior to implementation of Alternative C are the same as those described under Alternative B.

2.2.5 Alternative D - Drill well from Alternative A site using helicopter mobilization and support.

Alternative D would utilize the drill site and campsite described under Alternative A. Drill site access and support activities would be restricted to helicopter transport from a helicopter staging area. Two helicopter staging areas were determined as feasible during interdisciplinary review of the project. One proposed staging area, identified as D1 (Exhibit 2-1), is located approximately 3.75 miles north of the proposed well on a sagebrush bench overlooking the South Fork of Spread Creek, immediately north of Dry Lake Creek. This staging area would be accessed by the existing road as described under Alternative A, the Kettle Creek route. The other proposed staging area, identified as D2, is located approximately 4.50 miles south of the proposed well on a sagebrush terrace to the east of Dry Cottonwood Creek. This staging area is adjacent to the existing road that proceeds up the mountain towards Gunsight Pass. Access to this site would be the same as that described for the existing roads under Alternatives B and C to the intersection of the Dry Cottonwood Creek Road with the Cottonwood Creek Road in the NW 1/4 of Section 34, T42N, R112W (Exhibit 2-1). The actual staging area would be located about 0.75 miles further north of this intersection. Some minor reconstruction would be necessary to make this short road segment suitable for use (blading, shaping, and spot surfacing).

The drill rig and all related equipment and support materials would be transported by helicopter from the staging area to the drill site. Construction equipment needed for building the drill site would also be transported by helicopter. Access to either staging area would involve reconstruction or improvement of existing roads as described under Alternatives A and B, depending upon the staging area selected. The staging area would need to be large enough to allow for off-loading of equipment from trucks and to store and support material prior to loading the helicopters. The staging area would require fuel storage tanks, helicopter repair facilities, an office-storage building, a resident campsite for six persons with a water source and sanitary facilities. Also, the staging area must be large enough to base two helicopters and to park cars and snow removal equipment. Telephone and a source of electric power would also be needed. It is estimated that a surface area of 4 to 6 acres would be adequate to meet these needs of a staging area. To reduce flight costs and minimize disturbance created by large helicopters needed for mobilization, the staging area should be as close to the drill site or existing access as is technically and environmentally possible.

The drill rig would be mobilized to the helicopter staging area by conventional truck transport methods. The Amoco proposal would require transport of approximately 200 truckloads of drilling-related equipment and materials to facilitate the drilling operation. This figure includes the drill rig, drill pipe, drilling compounds, etc., but does not include the truck traffic required for resupplying the operation (e.g., fuel). Additional traffic would be variable, depending on the phases of the drilling operation, but should not include more than 2 or 3 vehicles per day throughout the drilling operation.

Drilling rig transport by helicopter is usually used in areas where it is physically impossible to access the site by conventional means due to steep slopes, marshy ground, or other obstacles. It may be possible to access the Sohare Creek Unit by constructing new road from either the north or the south access alternatives previously described, but not without a relatively high degree of environmental concern. The primary benefit in helicopter mobilization and support would be to allow the drilling of the exploratory well without access road construction into a roadless area, and if the well proved non-productive, the impacts of new road construction would be foregone, then benefit however, would be realized only if the proposed well is non-productive. If hydrocarbons were encountered, before a road and/or pipeline would be constructed to transport the product to treatment facilities, a field development plan and further environmental analysis would be required.

Most previous helicopter mobilization operations have been performed at low elevations, where helicopters are more efficient, and for shallow wells for which the drilling equipment was lighter and easier to transport. In recent years, several deep wells have been drilled at high elevations in rugged terrain in various parts of the world using helicopter mobilization. Sufficient records of these past operations have been accumulated to determine helicopter mobilization and support requirements for a high elevation operation. Required equipment and its corresponding gross weight, average weight per helicopter load, and the number of trips required to transport the individual and total pieces of equipment and materials for the Amoco proposal is summarized in Table 2-1.

Under this alternative, if producible quantities of oil are encountered, the well would be "shut in" and a detailed well field development plan and further environmental analysis would be required prior to production. Therefore, production for one well under this alternative is not considered since construction of roads would be required.

Lease unit stipulations requiring written waiver by the FS/BLM (or other written documentation/analysis) needed prior to implementation of Alternative D1 are the same as those described

Table 2-1 Helicopter Mobilization: Drill Site Equipment; Average Loads and Trips.

Equipment In	Weight (tons)	Average Load (tons)	Number of Trips
Drill Rig	750	2.5	300
Resident Camp	50	2.0	25
Blowout Equipment	25	2.5	10
Tanks, Bladders	35	2.0	18
Test, Logging	15	2.5	6
Drill Tools	25	2.5	10
Water Pump/Drill	25	2.5	10
Construction Equip.	50	2.0	25
Storage Racks/Sheds	50	2.0	25
Timber Mats	25	2.0	13
Supplies	125	2.0	63
Tubular Materials	600	2.8	218
Drilling Mud	500	3.0	167
Cement	350	3.0	117
Fuel	900	3.0	300
Gravel Surfacing	800	3.0	267
Total	4,325		1,574
Equipment Out*			
Drill Rig	750	2.5	300
Resident Camp	50	2.0	25
Blow Out Equipment	25	2.5	10
Tanks, Bladders	35	2.0	18
Test, Logging	15	2.5	16
Drill Tools	25	2.5	10
Water Pump/Drill	25	2.5	10
Construction Equip.	50	2.0	25
Storage Racks/Sheds	50	2.0	25
Timber Mats	25	2.0	13
Supplies	125	2.0	63
Drill Wastes	1250	3.0	417
Total	2,425		922
Total In and Out	6,750		2,496

* Number of trips may be reduced by the application of on-site disposal methods as directed by the Authorized Officer.

for Alternative A. Stipulations for Alternative D2 are the same as those described for Alternative B except for no surface occupancy on technically unsuitable soils on slopes in excess of 40 percent; no surface occupancy within 500 ft of the normal high waterline of any or all streams, lakes, ponds, and reservoirs and 400 ft of all springs and improvements located within the lease area; and no surface occupancy within 200 ft on either side of the centerline of any or all designated trails within the lease area except by written waiver by the BLM.

2.2.6 No Action Alternative - Amoco Production Company's APD Not Approved

Section 1502.14(d) of the National Environmental Policy Act (NEPA) requires that the alternatives analysis in the EIS "include the alternative of no action." "No Action" would mean the Amoco application to drill the proposed exploratory well (i.e., to test the target geologic structure) would be denied.

The Department of the Interior's authority to implement a No Action Alternative is limited. An explanation of this limitation and the latitude the Department has in this regard follows.

Background - An oil and gas lease grants the lessee the "right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits" in the leased lands, subject to the terms and conditions incorporated in the lease (Form 3110-2). Because the Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, restrictions are imposed on the lease terms (see Copper Valley Mach. Works, Inc. V. Andrus, 474 F. Supp. 189, 191; D.D.C. 1979; 653 F. 2d 595; D.D.C. 1981; Natural Resource Defense Council V. Bergland, 458 F. Supp. 925, 937; D.D.C. 1978).

The Tenth Circuit Court of Appeals in Sierra Club V. Peterson (717 F. 2d 1409, 1983) found that "on land leased without a No Surface Occupancy stipulation, the Department cannot deny the permit to drill;... once the land is leased the Department no longer has the authority to preclude surface disturbing activity even if the environmental impact of such activity is significant. The Department can only impose mitigation measures upon a lessee who pursues surface disturbing exploration and/or drilling activities..." The Court goes onto say, "Notwithstanding the assurance that a later site-specific environmental analysis will be made, in issuing these leases the Department made an irrevocable commitment to allow some surface disturbing activities, including drilling and road building" (ibid., pp. 1411, 1414-1415).

In the absence of a No Surface Occupancy stipulation covering the entire lease, restrictions based on oil and gas lease operations must be "reasonable." They cannot directly or indirectly,

prohibit, altogether, the development of the lease. Although a given APD can be denied, the right to drill and develop somewhere on the leasehold cannot be denied by the Secretary. Authority for complete denial can only be granted by Congress (Union Oil Company of California V. Morton, 512 F. 2d 743, 750-751; 9th Cir. 1975).

Lease and Unit Stipulations - Amoco's oil and gas lease (W-66212) and the Sohare Creek Unit Agreement contain various stipulations concerning surface disturbance, surface occupancy, special stipulations (regarding plan of construction and development, unstable soils, and wildlife habitat), and the Jackson Hole area oil and gas lease stipulation (see Appendix B). In addition, the lease stipulations (Form 3109-5) provide that the Department of the Interior may impose "such reasonable conditions, not inconsistent with the purposes for which (the) lease is issued, as the (BLM) may require to protect the surface of the leased lands and the environment."

None of the stipulations, however, would empower the Secretary of the Interior to deny all drilling activity because of environmental concerns. The lease provisions that expressly provide Secretarial authority to prohibit the lessee from occupying portions of the lease, unless an exception is specifically approved as the result of a detailed plan of construction and development, are as follows:

- Lands containing unstable/highly erodible soils.
- Lands containing slopes of 40 percent or greater.
- Critical habitat areas for elk calving, elk and moose forage areas.
- Areas within 500 feet of the normal high water line of any and all streams, lakes, ponds, and reservoirs; 400 feet of any and all springs; or 400 feet of any improvements.

Or, provisions which expressly provide Secretarial authority to deny APD development in whole or in part if a jeopardy opinion is rendered by the U.S. Fish and Wildlife Service for:

- Endangered or threatened species or habitats of plants or animals that are listed or proposed for listing (i.e., grizzly bear and whooping crane).

Constraints on "No Action" - Conditions under which "No Action" can be considered are constrained by the level at which the authority exists to deny activity upon the lease. The Secretary of the Interior, because of lease and unit provisions, has limited authority. Congress, on the other hand, has complete

authority. For these reasons, the discussion of "No Action" has been separated into two parts. The first considers the situation in which conditions exist for denial which are authorized by the lease under the authority of the Secretary. The second considers the situation where only Congress has the authority to deny the action (Table 2-2).

1. No Action Alternative - As Authorized by the Secretary of Interior

As stated above, Amoco's lease and the Sohare Creek Unit Agreement contain various stipulations which provide Secretarial authority to prohibit the surface occupancy of portions of the lease.

Chapter 3 of the draft EIS contains analysis of the presence or possible presence of lands within the affected area that contain the surface resource values of concern expressly stipulated in the lease and/or unit agreement. Chapter 4 contains analysis of the adverse impacts of the proposed action and alternatives on these surface resource values.

If any one of the stipulations cannot be acceptably implemented and impacts mitigated, then an exception could not be granted. A decision, therefore, of "No Action", as authorized by the lease, would be considered given one of the following conditions:

a) If there were no acceptable means of mitigating significant adverse impacts to the stipulated surface resource values, then this would trigger denial of the APD and require consideration and analysis of another alternative(s). Effectively, exception(s) to one or more of the lease stipulations would not be approved.

b) If the U.S. Fish and Wildlife Service concluded that the proposed action and alternatives would be likely to jeopardize the continued existence of any endangered or threatened plant or animal species, then the APD and lease development may be denied in whole or in part.

2. No Action Alternative - As Authorized by Congress

As the law now stands, the Secretary of the Interior has no authority to deny all activity upon the lease, except as described under the alternative "No Action - As Authorized by the Secretary of Interior." To deny all activity would constitute a "taking" of an operator's rights to conduct development activities on the lease lands. As the Court held in Union Oil Company of California V. Morton (512 F. 2d 743, 750-751; 9th Cir. 1975): "Congress itself can order the leases forfeited even now,

Table 2-2 Denial Authority as Applicable to Oil and Gas Lease W-66212 and Sohare Creek Unit Agreement

Denial Authority	Rationale for Denial	Portion Lease W-66212 Sohare Creek Unit	Entire Lease W-66212 Sohare Creek Unit
Sec. of Interior	Unstable/ highly erodible soils.	Yes	No
	Slopes 40 percent or greater.	Yes	No
	Critical habitat for elk calving, elk and moose forage.	Yes	No
	500 ft. of normal high water line of all streams, lakes, ponds & reservoirs.	Yes	No
	400 ft. of all springs.	Yes	No
	400 ft. of all improvements.	Yes	No
	Endangered or threatened species of plants or animals.	Yes	Yes
	Significant environmental impact.	Yes	No
Congress	Significant environmental impact	-	Yes

subject to payment of compensation. But without Congressional authorization, the Secretary of the executive branch in general has no intrinsic powers of condemnation."

The Secretary, therefore, could only suspend the lease pursuant to Section 39 of the Mineral Leasing Act pending consideration by the Congress of a grant of authority to preclude drilling and provide compensation to the lessees.

2.2.7 Alternatives Considered But Not Analyzed in Detail

In addition to Alternatives A, B, and C, the helicopter mobilization Alternative D, and the No Action Alternative, other alternatives considered but not fully evaluated due to their inability to meet environmental constraints, land and resources management objectives, and the proponents needs for an optimal initial test include the following:

- **Drill well from site located in SW 1/4 Section 2, T42N, R112W**

The drill site in Section 2 approximately 0.7 mile south of well site No. 1-35 was Amoco's original proposal for a preferred drill site location. However, after this site was thoroughly evaluated during the initial interdisciplinary team review for the environmental assessment completed in November 1986, and following additional seismic and exploratory well data interpretations from the previous Exxon drilling attempt, it was concluded that the optimum initial exploratory drill site would be the surface location in Section 35 T43N, R112W as described under Alternative A.

- **Gunsight Pass Access Route**

A possible access road from the end of an existing road in the vicinity of the Forest Service radio repeater site near Gunsight Pass (N 1/2 of Section 14, T42N, R112W), was identified during the preliminary analysis of the drilling proposal (See Exhibit 2-1). Subsequent on-site review of the route revealed that road layout could not be accomplished in accordance with established Oil and Gas Roading Guidelines for Region 4. An attempt was made to locate the route along the existing Gunsight Pass Trail, but average gradients along the trail were in excess of 25 percent with severe sideslopes approaching 80 percent in several locations. In addition, if drilling were non-productive, this access route would not be reclaimable over most of its length because of difficulties associated with reclamation over great cumulative distances of slopes in excess of 40 percent. This route alternative was eliminated from further consideration for these reasons.

o Ridge Access Route

A possible access route to the proposed drilling location from the abandoned Placid 1 drill site location in the NE 1/4 of Section 14, 42N, 112W, across a heavily timbered slope north of the abandoned Placid site was attempted. A route was located that averaged 8 percent over most of its length, but very steep sideslopes (75 percent and greater) and wet, unstable areas were encountered. This route could not be reclaimed over its entire length if drilling were non-productive. The ridge route was also eliminated from further consideration because of unmitigatable resource impacts.

2.3 Summary Comparison of Alternatives

Table 2-3 provides a data summary of the Proposed Action and alternatives. With the exception of the helicopter alternative, the Proposed Action and alternatives differ in location, not in major components.

Table 2-3 Comparison of Alternatives

Component	Alternatives A	B	C	D1	D2
Access Roads (miles)					
- in current use	12.9	37.1	37.1	12.9	30.8
- not in current use	5.7	-	-	3.6	-
- new construction[1]	3.3	13.2	11.6	0.0	0.0
- new construction across slopes in excess of 40%	0.7	2.2	1.6	0.0	0.0
Stream Environment					
- existing stream crossings	6	10	10	5	9
- new stream crossings[1]	2	7	6	0	0
- Total crossings	8	7	16	5	9
- miles of road construction within 500 feet of stream[1]	2.2	5.1	5.7	0.0	0.0
Disturbance/Land Clearing (acres)					
- drillsite/campsite	6.0	6.0	6.0	6.0	6.0
- helicopter staging area	-	-	-	4.0	4.0
- new road construction[1,2]	20.0	80.0	70.3	0.0	0.0
- Total	26.0	86.0	76.3	10.0	10.0

1 - includes new road construction and major road reconstruction
2 - assumes a 50-foot wide construction zone

CHAPTER 3

3.0 AFFECTED ENVIRONMENT

The affected environment chapter of this draft environmental impact statement (DEIS) discusses environmental, social, and economic factors as they currently exist within the area of influence of Amoco's proposal. The material described here has been guided by public issues identified through the scoping process and inter- disciplinary field analysis.

The following resources are not present in the analysis area or would not be affected by the proposal, and therefore will not be addressed in this chapter or in Chapter 4 (Environmental Consequences):

- Wild and Scenic Rivers
- Areas of Critical Environmental Concern (ACECs)
- Prime or Unique Farmland

Technical reports containing more detailed information than what is presented in this chapter and Chapter 4 were prepared by the consultant interdisciplinary team to provide the basis for the analysis of impacts to various resources in this EIS. They are available for review at the Bureau of Land Management (BLM) District Office in Rock Springs, Wyoming; the Bridger-Teton National Forest Supervisor's office in Jackson, Wyoming; and the Jackson and Buffalo Ranger District offices in Jackson and Moran, Wyoming.

3.1 GEOLOGY/PALEONTOLOGY

3.1.1 Geology

Amoco Production Company's Sohare Creek Unit consists of 18,429.52 acres of federal lands and minerals within T43N, R111W and 112W, Teton County, Wyoming. The Sohare Creek Unit is a surface anticline (the Sohare Anticline) located in the south-central Fish Creek Basin along a large structural trend extending northwestward from the southeastern Gros Ventre Mountains. This feature was created by the folding associated with the Laramide Orogenic event during the late Cretaceous-early Tertiary time.

Amoco's proposed target is the Sohare Anticline, a structural feature exposed on the surface and identified in the subsurface by seismic data and limited well control. Even though several unsuccessful wells have already been drilled on this structure, Amoco's proposal is essentially an entirely new exploratory pro-

ject. Their principal objectives are the Paleozoic Phosphoria, Tensleep, and Madison formations. None of these formations have been tested in this area. Amoco's proposal also identifies the Jurassic Nugget Formation as a secondary target. An earlier well penetrated the Nugget and encountered hydrocarbon shows, but was unable to test the formation. The proposed well should be a reasonable test of the Nugget and lower untested formations.

Four wells have been drilled in the Sohare Anticline; most recent were the Exxon No. 1 (1980) and No. 1-2 (1981) unit wells located on the same drill pad in Section 34, T43N, R112W. The No. 1-2, updip from No. 1 drilled a tight Phosphoria section on the steep west flank of the Sohare Anticline. The well encountered a thrust fault and was drilled to a depth of 10,925 feet in the subthrust Tensleep. The No. 1-2 was a non-commercial gas discovery completed October 2, 1981, from the Cretaceous Frontier and Muddy formations and subsequently abandoned. The Placid No. 1 Unit, Section 11, T42N, R112W (drilled in 1954) encountered good oil shows in the Nugget Sandstone, but was not tested due to hole conditions. The Tenneco No. 1 Unit, Section 14, T42N, R112W (drilled in 1957), a follow-up to the Placid well, was abandoned in red beds of the Triassic Chugwater Formation.

The Sohare Creek Unit includes, essentially, the entire Sohare structure, as defined at the Madison level. The eastern and southern boundary is established along the closing 2.800 second time structural contour on the top of the Madison Formation. Sealing thrust faults comprise the western and northern boundaries. No justification is given for selection of the 2.800 contour, but use of this contour permits inclusion of the entire structure in the unit. Each full section intersected by either the structural contour line or one of the faults is included in the unit area. The unit well is located in the SW 1/4, Section 35, T43N, R112W. Depth of the drilling would be approximately 11,000 feet or into at least the top 200 feet of the Madison Formation. The unit proposal appears to accommodate the interpreted geologic conditions and the proposed well should provide an adequate test of the unit geology and target formations.

3.1.2 Seismic Risk

The Sohare Creek Unit falls in Zone 2 or just on the edge of Zone 3 seismic (earthquake) risk area (Exhibit 3-1). Zone 2 is subject to moderate damage and corresponds to Intensity VII of the Modified Mercalli Intensity Scale of 1931.

3.1.3 Paleontology

Two general alternatives are considered for access to the drill site, the Kettle Creek route from the north (Alternative A and D1) and the Sohare Creek route from the south (Alternatives B, C,

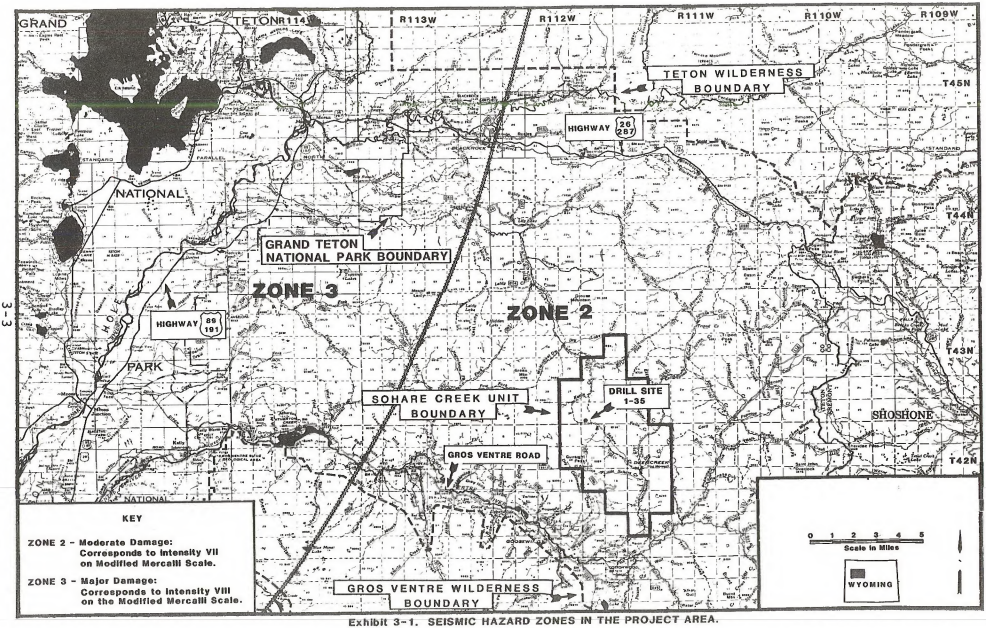


Exhibit 3-1. SEISMIC HAZARD ZONES IN THE PROJECT AREA.

and D2). The Kettle Creek route would require road improvement and construction from Lily Lake in Section 20, T44N, R112W south to the drill site. The constructed road begins in an upper Cretaceous lenticular sandstone, shale, and coal sequence. Fossil leaves may be found in the coaly sequence of this section. The road alternates back and forth between the Cretaceous and a Quaternary terrace gravel section until it enters the unit in Section 25, T43N, R112W. In Section 34, T34N, R112W, the road enters the Tertiary, Pinyon Conglomerate, a greenish-gray and brownstone and shale sequence containing Pinyon-type pre-Cambrian quartzite roundstones. The road ends in the SW 1/4, Section 35, T43N, R112W at the drill site, just off the north edge of a Quaternary alluvium.

The Sohare (Alternatives B, C, and D2) route leaves the Cottonwood Creek Road near Section 35, T42N, R112W in Quaternary alluvium, crosses over a short stretch of Cretaceous lenticular sandstone, shale, and coaly sequence in Section 31, T42N, R111W. This is the same Cretaceous section found on the Kettle Creek access and the same types of leaf fossils may be present. The access road enters the unit in Section 30, T42N, R111W in Quaternary alluvium and follows Cottonwood Creek and alluvium north through Sections 19 and 18 into Section 7. In Section 7, the access road turns up Sohare Creek into Cretaceous sediments (leaf fossils may be found) and follows the creek through Sections 12 and 1, T42N, R112W into Section 2, T42N, R112W where it again enters the Quaternary alluvium. The access road is in the alluvium through Section 2 and into Section 35, T43N, R112W to the proposed drill site.

3.2 AIR QUALITY

3.2.1 Introduction

Air quality in the affected area, although not monitored, is considered to be good to excellent with low ambient concentrations of pollutants. Minor, short-term occurrences of airborne pollutants may occur periodically in the affected area due to natural and prescribed fire, fires from logging slash, and coal and wood smoke generated during home heating in Jackson and surrounding communities. However, no pollution from industries in the area significantly affects the air quality of the proposed project area (USDA 1986). The prevailing wind direction in the area is from the northwest in the winter and the southwest in the summer. The rough and mountainous terrain in combination with diurnal changes in temperature greatly alters the surface air flow over the affected area and provides for continuous air movement. Generally, local upslope winds occur from late morning through late afternoon, and local downslope winds occur from evening through the mornings. These factors provide good disper-

sion rates. No areas of poor dispersion are known to occur in the affected area.

The affected area has been designated as Class II, which include areas that may be industrialized with release of certain pollutants within the requirements of State of Wyoming Division of Air Quality's ambient and prevention of significant deterioration (PSD) standards. Class I areas, including wilderness areas and national parks, have more stringent standards than the Class II areas. The nearest Class I areas to the proposed drill site are the Teton Wilderness and Grand Teton National Park, approximately 16 miles north and 16 miles west of the location, respectively. The Gros Ventre Wilderness and Wilderness Study Areas have retained a Class II classification (USDA 1986).

3.2.2 Drill Site

Refer to the above description of air quality in the affected area.

3.2.3 Access Alternatives

The above description of air quality in the affected area applies to all access alternatives under consideration.

3.3 TRANSPORTATION

3.3.1 Introduction

The major transportation system in the project vicinity consists of a network of roads connected to the U.S. highway system. The U.S. highways serving the Jackson-Teton area, as shown in Exhibit 1-1, are 89-191, 26, and 287. The portions of these highways found within the project area are scenic routes. Two state numbered highways, 390 and 22, also service the Jackson area.

Highway use data for the state of Wyoming is limited (Fanter 1987). In 1985, a total of 13,785 accidents were reported, 0.2 percent occurring on Forest Service or National Park Service roads, 9.8 percent on county roads, and the remainder on all other forms of roadways. The accident rate for Wyoming in 1985 was 266 accidents per 100 million miles, of which 10 percent involved fatalities.

Service levels along a highway are a reflection of driver comfort and do not incorporate safety factors. Service levels are described in Table 3-1.

The largest system of roads in the project vicinity exists within the National Park and National Forest lands. The Bridger-Teton National Forest contains approximately 1,600 miles of roads. It

Table 3-1. Conditions For Levels of Service

Level A -	Free flow; speed not restricted, safe passing sight distance.
Level B -	Stable flow in upper speed range; speeds beginning to be restricted, safe passing sight distance.
Level C -	Stable flow in lower speed range; traffic more congested and maneuverability more restricted.
Level D -	Approaching unstable flow; temporary traffic restrictions cause substantial drops in speed, little freedom to maneuver.
Level E -	Flow unstable; volumes approaching capacity, momentary traffic stoppages.
Level F -	Forced flow; volumes at or near capacity, lines form, no passing.

is estimated that the cumulative distance of roads will increase by 101 miles in the next 10 years and 452 miles in the next 50 years (USDA 1986). Road density within the National Forest is approximately 0.3 miles per square mile.

The Bridger-Teton National Forest classifies roads into arterial, collector, and local classifications (USDA 1986). Arterial roads have an average speed of 30-55 mph and are generally two lanes. These roads are all-weather, usually having an asphalt or gravel surface. Typical road width is 20 to 24 feet with some single lane areas containing intervisible 10-foot turnouts. The road drainage is permanent and does not impede traffic. Collector roads have an average speed of 10-30 mph. These roads are generally gravel or native surface but may be asphalt. These roads are generally single lane with a width of 12 to 24 feet and contain intervisible 10-foot turnouts. The drainage is permanent but may impede traffic. Local roads have an average speed of less than 20 mph. Road surface varies, but most roads are composed of native surface. These roads are generally single lane except for those at developed recreation sites. Road width is 10 to 14 feet. Turnouts are optional, depending on traffic management in a particular area. Turnouts are usually not intervisible. Road drainage is with dips and culverts.

National Forest roads are managed according to specific objectives, maintenance levels and traffic regulations (USDA 1986). Details on these objectives, and the five categories of main-

tenance are contained in the Bridger-Teton National Forest Management Plan (USDA 1986).

An intricate network of pack and foot trails are located in the project area (see Exhibit 3-11). The proposed Continental Divide National Scenic Trail is located east of the proposed project area.

3.3.2 Drill Site

There are no roads in the immediate vicinity of the proposed drill site as indicated in Exhibits 1-1 and 2-1. The closest road to the site is the local improved/unimproved road to Gunsight Pass approximately 1.5 miles south of the site. Two pack trails converge on the drill site area from the south: the Sohare Creek Trail, and the Gunsight Pass Trail. Both trails converge approximately 0.5 miles east and downslope of the drill site. Approximately 0.2 miles west on this convergence, the trail splits, one trail heads west and up the Sohare Creek drainage over the divide and down into upper Kettle Creek. The other trail heads due north over the divide and down into upper Kettle Creek. Both trails then converge in the Kettle Creek drainage and terminate at the end of the road that parallels the South Fork of Spread Creek.

3.3.3 Access Alternatives

3.3.3.1 Alternative A

3.3.3.1.1 Existing Roads

Access to the proposed drill site would be from U.S. Highway 287 by the existing Flagstaff and Leidy Creek Roads within the Bridger-Teton National Forest. Flagstaff Road crosses to the south side of Blackrock Creek, parallels the Flagstaff Creek drainage to the North Fork of Spread Creek, then parallels that drainage to a road intersection near Lily Lake. This 9-mile section of road is classified as a collector road and is basically in good condition. From here, the roads are classified as local roads, both improved and unimproved. For the next 3.2 miles, the road follows the South Fork of Spread Creek to another road intersection. The creek has undercut the roadbed in two short sections. The road crosses the South Fork of Spread Creek and continues for 4.5 miles to a large sagebrush bench. A large fill section in a drainage just north of this area shows signs of erosion from subsurface water. A short distance beyond the bench the existing road crosses an untreated timber bridge constructed over Dry Lake Creek. The road continues along a wet and unstable hillside above the South Fork of Spread Creek, crosses this drainage and then enters the Kettle Creek drainage, where the existing road terminates, a distance of 1.9 miles from the Dry Lake Creek Bridge. Approximately 0.2 miles of this section

traverses the unstable hillsides, crossing the lower portion of several slumps. Increased instability of this hillside was probably caused by the construction of this road in that it is cut into the hillside, creating an imbalance in the earth mass. Attempts have been made to stabilize the area. This road section was used by a timber operation in the winter and unusually wet spring of 1986 and appeared to remain stable.

Leaving the existing road towards the mouth of Kettle Creek, there is a road which was used for a previous drilling prospect. This road has been completely rehabilitated, the earth has been regraded according to natural contours and revegetation has occurred. This route lies adjacent to Kettle Creek and the foot of the east facing slope. It traversed slopes in excess of 40 percent for approximately 3,700 feet, with 400 feet of this being between 60-70 percent (maximum slope).

3.3.3.1.2 Road Use

U.S. Highway 287 has an average daily traffic flow of 1,170 vehicles per day at the entrance/exit point to the proposed drill site (Wyoming Highway Department 1987). Heaviest traffic on Highway 287 occurs in the summer months, when tourism in the National Forest and National Parks is highest. This highway is classified as having a Service Level E, which indicates that traffic is at an unstable flow. The accident rate for Highway 287 is presently 1.01 per million vehicle miles.

Drilling-related traffic would probably originate in the Casper area and travel through Riverton and Dubois on U.S. Highway 287 to a point approximately two miles east of the Togwotee Lodge.

Commercial timber operations utilize the Flagstaff and Leidy Creek Roads. Trucks travel these roads approximately 250 days per year with approximately 8 truckloads hauled per day. Operations are prohibited March 15 through June 1. Some accidents occur between logging trucks and recreational vehicles, occurring primarily on poor road sections (e.g., blind curves). Ninety-five percent of the hauling is to Dubois with the remaining 5 percent going to Afton via Jackson.

This alternative would utilize 18.6 miles of existing road and 3.3 miles of new road construction. No paved Forest Service roads would be utilized.

3.3.3.2 Alternative B

3.3.3.2.1 Existing Roads

Access to the drill site would be from U.S. Highway 89-191, using the Gros Ventre Road through the town of Kelly to the National Park-National Forest boundary, a length of approximately 10.5

miles (see Exhibit 1-1). This segment of road has a Service Level of D. This road is a paved, all-weather road which has been used for previous drilling and timber operations. The existing surfacing is a thin layer of inverted penetration or hot plant mix asphalt not designed for heavy traffic. This pavement has not been well maintained; most of the volatiles have been driven off, leaving a dry, brittle, cracked surface that is subject to break up under heavy traffic.

From the National Forest boundary, the road is classified as an arterial road, remaining paved for 3.7 miles to a point near Lower Slide Lake. This road is similar to the road in the Park in that the original paved surface was not intended for heavy traffic, and it is also in need of maintenance. From the end of the pavement, the road becomes a collector road for 15.7 miles to the Goose Wing Ranch turnoff. This road has not been used for year-round traffic and is in need of upgrading for drainage, snow removal, and heavy and increased traffic. The first three miles of this road is on a steep side hill above Lower Slide Lake and the Gros Ventre River. The road follows the natural terrain and has many sharp curves. There are three major bridges, two of these cross the Gros Ventre River and one crosses Crystal Creek. The first bridge over the Gros Ventre and the bridge over Crystal Creek are adequate for heavy traffic. The second bridge over the Gros Ventre River has been damaged by ice flow or by a build-up of debris and is not safe for heavy traffic.

From the Goose Wing Ranch, the road becomes a local unimproved road. The road initially traverses the foot of the slope on the west side of the Cottonwood Creek drainage with about 4,000 feet of this having a cross slope in excess of 40 percent. The road then drops into the bottom of the drainage, crossing Cottonwood Creek twice. It then continues north, between the stream channel and the steep sidehill to the Forest Service road closure, near Sohare Creek. This portion of the route would utilize 7.2 miles of existing road. The section between the upper creek crossing and the road closure traverses approximately 2,500 feet of cross slope in excess of 40 percent.

This alternative would utilize 37.1 miles of existing road of which 14.2 miles is paved, 13.2 miles of new construction.

3.3.3.2.2 Road Use

U.S. Highway 89-191 has an average daily traffic volume of 2,670 vehicles per day at the entrance/exit point for project-related traffic (Wyoming Highway Department 1987). Heaviest traffic occurs in the summer months when tourism in the National Forest and National Parks is highest. Traffic on this road is at Service Level E. The accident rate is 2.04 per million vehicle miles. Drilling-related traffic would originate in either Evanston or Casper. Evanston traffic would access the area via Big Piney and

Jackson, whereas Casper traffic would travel through Riverton, Dubois, and Moran.

There are no commercial green sawtimber operations currently utilizing the Gros Ventre Road. Pole logging and firewood cutting occurs between June and November, producing 5 to 6 truck loads per day. Trucks used for hauling are generally less than 3 ton.

3.3.3.3 Alternative C

Alternative C would involve the same existing road system as Alternative B. This route would use 37.1 miles of existing road and 11.6 miles of new road construction.

3.3.3.4 Alternative D

3.3.3.4.1 Alternative D1

The helicopter pad in this alternative would be accessed by the existing road system described for Alternative A up to the sagebrush bench overlooking the South Fork of Spread Creek immediately north of Dry Lake Creek. This alternative would utilize 16.5 miles of existing road, none of which is paved.

3.3.3.4.2 Alternative D2

Access to the helicopter pad in this alternative would be the same as described for Alternative B along Gros Ventre Road to the Goose Wing Ranch. From here, the road proceeds up a mild slope for 0.9 miles to the staging area. This alternative would consist of 30.8 miles of existing road of which 14.2 miles are paved.

3.4 SOILS

3.4.1 Introduction

The soils of the project area have formed from a variety of sources including bedrock (sedimentary, igneous, and metamorphic rocks); colluvium including land and debris slides; stream deposited alluvium; and glacial deposits such as moraines and outwash plains. Soils are predominantly deep within the area except on steep slopes of exposed ridgelines. Soil development ranges from little horizon differentiation on land surfaces of recent age to well developed subsoils on older land surfaces.

Surface organic matter content is moderate to high depending on the vegetation community covering the soil. Soil fertility is mostly moderate. The soils at certain locations within the project area may have several limiting factors which could affect the success and feasibility of constructing and operating the proposed project (Exhibit 3-2). Limiting factors include stabil-

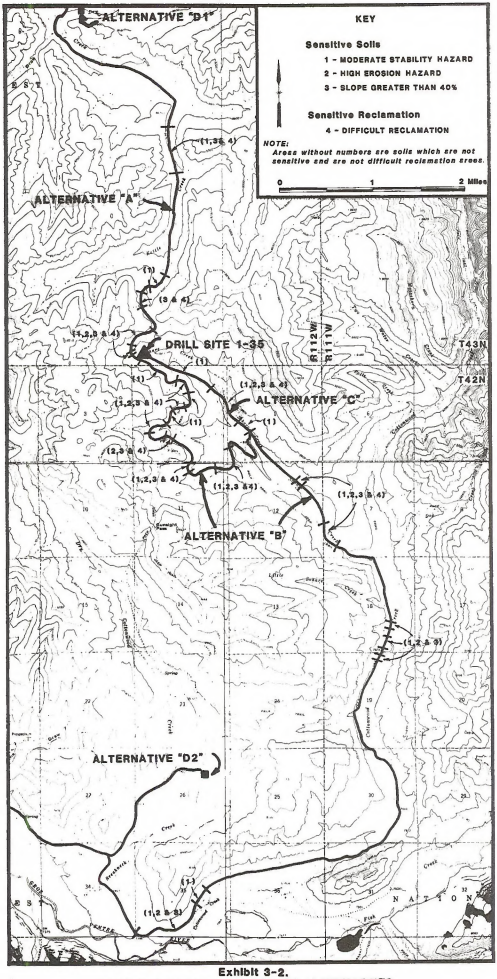


Exhibit 3-2.
SENSITIVE SOILS ALONG ACCESS ALTERNATIVES.

ity problems, high erosion, difficult revegetation, and construction on slopes greater than 40 percent. Table 3-2 summarizes the soil characteristics of the proposed action and alternatives. The terms stability hazard, erosion hazard, reclamation potential, and revegetation potential are defined in Appendix C-4.

3.4.2 Drill Site

The proposed drill site would be located on alluvial deposits, except the southeast corner, which would be on a toeslope. Slopes at the site are mostly 8 to 12 percent but range from 20 to 40 percent on the southeast corner. Erosion hazard is moderate on cuts and fills, and low on the level portion of the pad. Stability hazard is mostly low but ranges to moderate on the southeast corner. Revegetation potential is fair due to very gravelly textures on part of the site.

3.4.3 Access Alternatives

3.4.3.1 Alternative A

This alternative would cross intermingled steep mountain slopes, toeslopes, and alluvial fans. Dominant soils are deep and very gravelly, with lesser amounts of deep loamy soils. Erosion hazard is moderate for approximately 80 percent of the route with smaller areas along the access route having both low (10 percent) and high (10 percent) erosion hazard (Table 3-2). Stability hazard is mostly (70 percent) low along the route with a lesser amount rated as moderate (30 percent). Revegetation potential is mostly fair (75 percent) due to very gravelly textures and steep slopes, with a smaller amount having good (25 percent) reclamation potential.

At a point within one quarter mile of the terminus of the existing road up the South Fork of Spread Creek there is a series of about 5 to 6 small landslides that are causing a continuing road maintenance problem. Each of the individual slides is 50 to 100 feet wide and extend upslope from the road. In past years, slide material moving downslope encroached on the road, and the wet clayey material has caused poor bearing strength in the roadbed. These small landslides did not move in the spring of 1986, and the road is presently marginally passable at this point.

3.4.3.2 Alternative B

This alternative would cross extensive areas of gravelly alluvial soils along Cottonwood and Lower Sohare Creeks. In these areas, the route occasionally cuts into the toes of steep valley exhibit 3-2 sensitive soils sideslopes to avoid wet alluvial bottomlands. In the upper Sohare Creek watershed the route crosses inter-

Table 3-2. Summary of Soil Characteristics in areas of new disturbance within the Project Area.

	ALTERNATIVE				
	A[1]	B[2]	C[2]	D1	D2
ROADS:					
Total Road Construction (miles)	3.3 mi	13.2 mi	11.6 mi	N/A	N/A
Slopes>40%	0.8 mi	2.2 mi	1.5 mi	-	-
Erosion Hazard					
Low	0.3 mi	7.5 mi	7.5 mi	-	-
Moderate	2.6 mi	3.5 mi	2.5 mi	-	-
High	0.3 mi	2.2 mi	1.5 mi	-	-
Stability Hazard					
Low	2.3 mi	10.2 mi	8.8 mi	-	-
Moderate	0.9 mi	3.0 mi	2.75 mi	-	-
Revegetation Potential					
Good	0.8 mi	5.4 mi	4.5 mi	-	-
Fair	2.4 mi	7.8 mi	7.0 mi	-	-
HELICOPTER STAGING AREA:	N/A	N/A	N/A		
Erosion Hazard					
Low	-	-	-	4.0 ac	4.0 ac
Stability Hazard					
Moderate	-	-	-	4.0 ac	4.0 ac
Revegetation Potential					
Fair	-	-	-	4.0 ac	4.0 ac
DRILL SITE:					
Erosion Hazard					
Low	5.5 ac	5.5 ac	5.5 ac	5.5 ac	5.5
Moderate	0.5 ac	0.5 ac	0.5 ac	0.5 ac	0.5
Stability Hazard					
Low	5.5 ac	5.5 ac	5.5 ac	5.5 ac	5.5

[1]Alt A - Includes reconstruction of the reclaimed Kettle Creek Road.

[2]Alt B & C - Includes major reconstruction of the existing Cottonwood Creek Road.

mingled gently sloping to steep sideslopes. The soils are deepalong almost all of the route. Textures are mostly very gravelly on alluvium along Cottonwood and Sohare creeks with lesser amounts of loamy alluvium. Textures on sideslopes are mostly loamy or very gravelly loam and sandy loam. Erosion hazard is mostly low (55 percent) to moderate (25 percent), but there is also a significant (28 percent) component with a high erosion hazard (Table 3-2). Stability hazard is low on about three-fourths of the route and moderate on about one-fourth. Revegetation potential is mostly (80 percent) fair due to very gravelly textures and steep elopes, but there is also a significant (20 percent) area with good potential.

3.4.3.3 Alternative C

This alternative route would cross extensive areas of gravelly alluvial soils along Cottonwood Creek and lower Sohare Creek. As with Alternative B, the route occasionally cuts into the toes of steep valley sideslopes to avoid wet alluvial bottomlands. In the upper Sohare Creek watershed, the route crosses intermingled gently sloping to steep sideslopes. The soils are deep along almost all of the route. Textures are mostly very gravelly on alluvium along Cottonwood and Sohare creeks with lesser amounts of loamy alluvium. Textures on sideslopes are mostly loamy or very gravelly loam and sandy loam. Erosion hazard is mostly low (55 percent) to moderate (25 percent), but there are also areas with high (20 percent) erosion hazard. Stability hazard is low on about three-fourths of the route and moderate on about one-fourth. Revegetation potential is mostly fair (60 percent) due to very gravelly textures and steep slopes, but there is also a significant area with good potential (40 percent) (Table 3-2).

3.4.3.4 Alternative D

The northern and southern helicopter staging area alternatives (D1 and D2) have similar soil and landform characteristics. They are on nearly level to gently sloping alluvial terraces. The soils are deep and have loamy surface layers over very gravelly loamy sand subsoils. Erosion and stability hazards are low. Revegetation potential is fair due to thin topsoil and very gravelly textures (Table 3-2).

3.5 WATER RESOURCES

3.5.1 Introduction

The proposed Sohare Creek Unit 1-35 project area is drained to the north by Kettle Creek and Spread Creek, which flow into the Buffalo Fork River; and to the south by Sohare Creek and Cottonwood Creek, which flow into the Gros Ventre River (Exhibit 2-1). All drainage is ultimately into the Snake River and out the

Columbia River to the Pacific Ocean. Elevation of the analysis area varies from 7,440 feet at the confluence of Cottonwood Creek with the Gros Ventre River, to over 10,000 feet at the higher ridgelines. Slope aspects and gradients are highly variable in the area.

Due to its mountain location and associated orographic influence, the analysis area receives considerable snowfall. The snow accumulates from November through April. Table 3-3 presents average maximum snow accumulation and snow water equivalents. The maximum accumulations typically occur in mid to late April as indicated by five snow courses, which measure snow accumulation, located in the vicinity of the study area. These snow courses can be used to index snow conditions within the affected area.

Average annual precipitation is approximately 45 to 55 inches at the higher elevations and 15 to 25 inches at the lower elevations. Precipitation is distributed evenly throughout the year with the majority falling in the form of snow. Snowmelt commences in late April or early May and terminates in late June. Typically, peak runoff occurs in June in response to peak snowmelt or rain-on-snow events. Base flows dominate the hydrographs of the streams in the general area from September through March with minimum flows occurring during the fall and winter months. Surface water quality is considered good to excellent with relatively low dissolved solids and turbidity. However, during heavy rainstorms or rapid snowmelt, sediment loads typically increase with increased streamflow discharges.

The streams within the analysis area are not and have not been gauged. Consequently, streamflow data are not available. Lowham (1976) was used to estimate flows in these ungauged streams based on physiographic character of the stream basins. These estimated flows are presented, where appropriate, in the discussion of each alternative.

Groundwater in the area occurs in two general geologic formations including unconsolidated alluvium and colluvium of stream and river valleys, and consolidated and semi-consolidated sedimentary and low grade metamorphic strata. Springs and seeps are common in the area, issuing primarily from bedding planes within the sedimentary rock. The chemical quality of groundwater in the area is good.

Primary uses of the water resources in the area are wildlife and fish habitat, and livestock. Downstream, uses beneficial to humans occur. No known wells or surface water diversions for irrigation and domestic use are known to occur in the vicinity of the proposed project. The closest locations of such uses, such as water diversion for irrigation, occur out of the project area downstream along the Gros Ventre and Buffalo Fork rivers.

Table 3-3. Elevation, location, average maximum snow accumulation, and snow water equivalents for five snow course stations near the study area (taken from SCS 1983).

Station Name	Elevation (feet)	Location[1]	Average Maximum Snow Accumulation (inches)	Average Maximum Snow Water Equivalents (inches)
Elbo Ranch	7,100	16 mi W	48	14.2
Togwotee Pass	9,580	12 mi NE	90	38.5
Blackrock	8,900	12 mi NE	69	27.0
Four Mile Meadows	7,860	12 mi N	46	13.8
Turpin Meadows	6,900	36 mi N	36	10.7

1 - location in relation to the study area.

3.5.2 Drill Site

The proposed drill site is located in the headwaters of the northern branch of Sohare Creek at a valley bottom position. The drill site is immediately adjacent to the lowest portion of the valley, however, at this high point in the watershed, no perennial or intermittent channel has formed. Surface flow is ephemeral within a swale in the immediate vicinity of the drill site. The first evidence of a perennial stream occurs approximately 0.5 miles downslope of the drill site. The drill site is primarily well drained with moderately rapid permeability (2.0 to 6.0 inches per hour). Surface runoff and erosion potential are medium.

Three cased observation wells (30 feet deep and 4 inches in diameter) were constructed in February 1986 to measure the groundwater level. The wells were probed shortly after completion and later in the summer to determine if a water table was present within 30 feet of the ground surface. No standing water was found at either time. This suggests that the water table is below the 30-foot depth. Groundwater likely occurs below the site by the nature of the site's valley bottom positions, however, permeability rates and the probable great depth of colluvium and alluvium may produce a water table below the 30 foot depth of the wells. The water table is expected to rise temporarily in the spring and early summer in response to snowmelt.

3.5.3 Access Alternatives

3.5.3.1 Alternative A

Access Alternative A would originate from the existing improved Flagstaff Creek Road to the north of the project area. The existing road makes approximately six crossings of Spread Creek from Flagstaff Creek to its confluence with Kettle Creek as indicated in Exhibit 2-1. This segment of the creek was estimated to have a mean annual flow of approximately 10 cubic feet per second (cfs), and a 100-year peak flow of 500 cfs using Lowham (1976). This segment of the creek has a well developed riparian willow zone across its floodplain. At a point along the existing road approximately 0.2 miles downstream of the confluence of Kettle Creek and Spread Creek, the steep slopes along the east side of Spread Creek exhibit active slumping and mass failure resulting in debris partially covering the existing road. These slumps may contribute sediment to the South Fork of Spread Creek.

Just below the confluence of the South Fork of Spread Creek and Kettle Creek, the access route would cross the South Fork of Spread Creek and follow the route of a reclaimed well site access road paralleling Kettle Creek to the confluence of the west branch of Kettle Creek. The route would deviate from the reclaimed road, cross the west branch of Kettle Creek and continue south up and along the south fork of Kettle Creek to the drainage divide with Sohare Creek. At the site of the west branch crossing, Kettle Creek is estimated to have an annual flow of approximately 1 cfs, and a 100-year peak flow of 100 cfs. The south branch of Kettle Creek is marginally perennial at this headwater location. Consequently, mean annual flow can be expected to be less than 1 cfs with a 100-year peak flow of near 50 cfs. Numerous perennial seeps and riparian willow along the streams would be traversed along this segment of this route.

From the Kettle Creek - Sohare Creek divide, the route would traverse steep (30 to 70 percent) slopes down to the drill site location. Several high energy ephemeral channels and the alluvial fans in which they terminate would be crossed by the proposed road. This segment of the route would then cross the valley bottom of upper Sohare Creek to the drill site.

3.5.3.2 Alternative B

Access to the drill site would originate from highway 89-191 in Grand Teton National Park. From this origin, the access route would follow the Gros Ventre Road to a point upstream of Upper Slide Lake. Seven major stream crossings occur along this existing road segment including 2 crossings of the Gros Ventre River. From the Gros Ventre Road the route would follow an existing improved road for two miles where it would then deviate and follow an unimproved road to the Cottonwood Creek drainage.

Three streams, Coal Mine Draw, Dry Cottonwood Creek and Breakneck Creek, would be crossed along the existing road segment.

The access road then follows an existing unimproved road paralleling or crossing Cottonwood Creek four times for a distance of approximately four miles before terminating at the confluence of Sohare Creek. These crossings are currently fords. This portion of Cottonwood Creek is estimated to have a mean annual flow of approximately 20 cfs, and a 100-year flow of 800 cfs. The stream has a relatively wide floodplain for its size. The creek is braided in many portions of its course. A well established riparian willow zone exists along Cottonwood Creek. Unstable landforms and slopes are typical of this segment. Consequently, sedimentation of the stream along this segment is greater than that along most streams and stream reaches in the affected area.

New road construction would parallel Sohare Creek for a distance of approximately 2.1 miles from its confluence with Cottonwood Creek. A portion of this distance would include construction in the riparian zone as well as on the steep valley sideslopes adjacent to the creek and three crossings of the creek. Mean annual flow along this portion of Sohare Creek is estimated to be approximately 2 cfs with a 100- year peak flow of 120 cfs.

From Sohare Creek, the new access road to the drill site would traverse primarily uplands except for crossing a southern branch of Sohare Creek as well as several ephemeral and intermittent channels. Mean annual flow at the southern branch crossing is estimated to be approximately 0.5 cfs with a 100-year flow of 65 cfs. Most of these areas are not in close proximity to intermittent and perennial streams. Numerous perennial seeps would be traversed by this segment of the route, several of which are perched on steep slopes of 50 percent or more.

This access alternative would involve utilizing 10 existing stream crossings and the construction of an additional 7 crossings.

3.5.3.3 Alternative C

The water resources of this route would be the same as described under Alternative B from the Gros Ventre River to the point where Alternative B access route would diverge from Sohare Creek. From this point, the new road would closely parallel Sohare Creek on its south side at a valley bottom or lower slope position for approximately 0.6 miles. For the last mile, the road would deviate from the stream environment into timbered lower slopes to the drill site.

This access alternative would involve utilizing 10 existing stream crossings and the construction of an additional 6 crossings.

3.5.3.4 Alternative D

3.5.3.4.1 Northern Staging Area (D1)

The description of water resources associated with Alternative A applies to this alternative up to the confluence of Kettle Creek with the South Fork of Spread Creek. The staging site is located on a relatively dry, open alluvial bench above and approximately 0.25 miles east of the South Fork of Spread Creek and north of Dry Lake Creek. The site is well drained with low erosion and runoff potential. Access to this staging area would involve the utilization of 5 existing stream crossings.

3.5.3.4.2 Southern Staging Area (D2)

This helicopter staging area would be located on a relatively flat and gently sloping terrace above and 0.25 miles east of Dry Cottonwood Creek. The site is well drained with low erosion and runoff potential and is located away from existing drainages and perennial seeps. Access to this staging area would involve the utilization of 9 existing stream crossings.

3.6 FISHERIES

3.6.1 Introduction

The northern portion of the project area lies within the Kettle Creek and Sohare Creek drainages, which are tributaries of the Buffalo Fork River. The southern portion lies within the Sohare and Cottonwood Creek drainages, which are tributary to the Gros Ventre River. Both the Buffalo Fork and Gros Ventre rivers are tributary to the Snake River. Perennial streams in the project area provide cold water habitats and contain several game fish species, including naturally reproducing and native Snake River cutthroat trout. The recreational activity of fishing is discussed in greater detail in the Recreation Section. There are no known federally listed threatened or endangered species of fish in the Buffalo Fork or Gros Ventre rivers or associated tributaries.

3.6.2 Drill Site

The drill site is located in the Sohare Creek watershed 0.5 miles above a point at which a perennial channel has developed. Consequently, there are no fishery resources in the vicinity of the drill site.

3.6.3 Access Alternatives

3.6.3.1 Alternative A

The primary drainages in the vicinity of this access alternative include Kettle Creek, South Fork of Spread Creek, and upper Sohare Creek, which was previously described. The position of the planned access road in relation to these streams was previously described in the Water Resources Section. Kettle Creek and the South Fork of Spread Creek have both been given a Class 3 status by the state of Wyoming, with the predominant sport fish being cutthroat trout. These streams are primarily of local importance and may have some habitat limiting factors. The populations are wild and naturally reproducing. The Kettle Creek population has been identified as sensitive because of the small size and limited habitat (Huddelson 1986).

3.6.3.2 Alternative B

Sohare and Cottonwood creeks are the only major perennial streams associated with this alternative containing significant fisheries. A description of the position of the planned access road relative to these streams is presented in the Water Resources Section. Cottonwood Creek has been classified as a game fishery, by the state of Wyoming and as a Class 2 stream, which indicates that the stream is of good fishery value. Sohare Creek has been classified as a Class 3 stream, which indicates that the stream is of fair fishery quality. There is little fishery information on the stream, but it is known to contain a moderate reproducing population of cutthroat trout (Huddelson 1987).

3.6.3.3 Alternative C

The fishery resources associated with this alternative are the same as described for Alternative B.

3.6.3.4 Alternative D

3.6.3.4.1 Northern Staging Area (D1)

Fishery resources in the area of this alternative include those previously described for the South Fork of Spread Creek.

3.6.3.4.2 Southern Staging Area (D2)

Fishery resources in the area of this alternative were previously described under Alternative B.

3.7 VEGETATION, TIMBER, AND RANGE RESOURCES

3.7.1 Introduction

The affected environment of the proposed drill site and access alternatives is typical of the montane zone of the Middle Rocky Mountain geographic region. The area is mountainous with steep, contrasting slopes which provide for distinctly different and variable microclimates within a relatively small area. The highly variable slope position, aspect and gradient, and soil type typical of the area causes a great degree of variability in the vegetation community types and distribution of these types in the affected environment.

Approximately eight distinct vegetation community types are distributed within the affected environment. These include six upland types: spruce-fir, mixed pine, mountain grassland, upland meadow, sagebrush, and timber harvest areas and two wetland types: wet subirrigated meadow and riparian willow. The mountain grassland type is limited to dry ridgelines at higher elevations and does not occur along the specific components of this proposal. Similarly, timber harvest areas occur in the northern part of the project area but would not be intersected by any of the project components. Both the wet subirrigated meadow and the riparian willow types meet all three criteria used to positively determine the existence of a wetland following the Army Corps of Engineers methodology (COE 1985): 1) the presence of hydrophytic plants; 2) the presence of hydric soils; and 3) existence of either perennial surface or subsurface water to support 1 and 2 (above).

These vegetation community types and their general occurrence within the affected area are described in Appendix C-1. Their distributions are shown in Exhibit 3-3. For ease of presentation in this exhibit, these types have been lumped into forested (spruce-fir and mixed pine), non-forested (sagebrush, upland meadow, and mountain grassland), timber harvest, and wetland (wet subirrigated meadow and riparian willow) groups. The cumulative distances of each vegetation type that new road construction or major reconstruction of existing roads would traverse are presented in Table 3-4 for each alternative.

The forested types represent several climax habitat types as described by Steele, et al. (1983). The predominant habitat type represented by the spruce-fir community and portions of the mixed pine community includes the subalpine fir/grouse whortleberry type including the whitebark pine, pinegrass, and grouse whortleberry phases. The mixed pine community with reproducing whitebark pine represents several habitat types of the whitebark pine series, with the predominant type being whitebark pine/grouse whortleberry type.

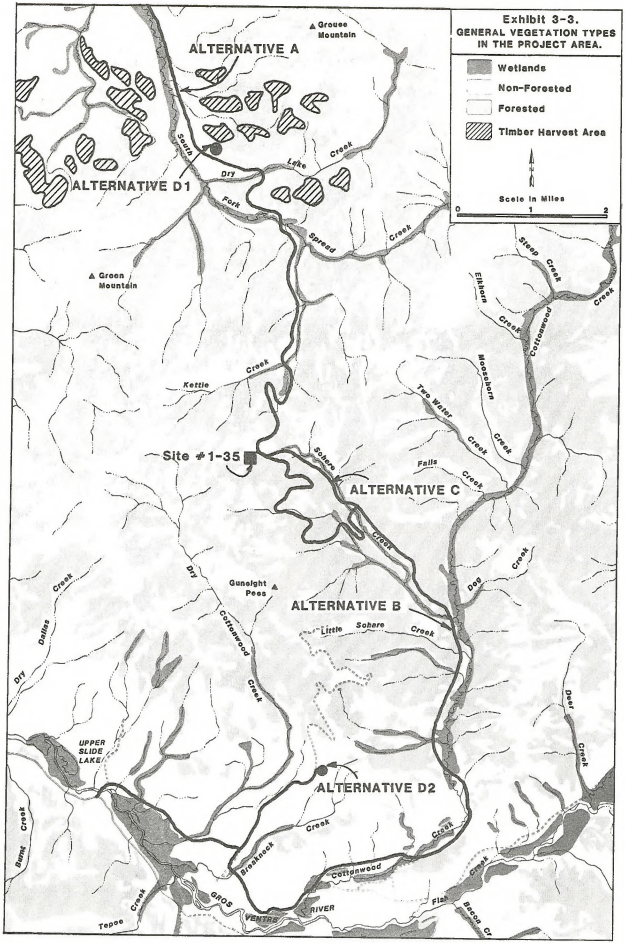


Exhibit 3-3.
GENERAL VEGETATION TYPES IN THE PROJECT AREA.
Wetlands
Non-Forested
Forested
Timber Harvest Area
Scale in Miles
0
1
2
ALTERNATIVE A
ALTERNATIVE D1
ALTERNATIVE C
ALTERNATIVE B
ALTERNATIVE D2
Site #1-35
Grouse Mountain
Green Mountain
Gunsight Pass
UPPER SLIDE LAKE
GROS VENTRE RIVER
South Fork Dry Creek
Spread Creek
Kettle Creek
Sheep Creek
Elkhorn Creek
Cottonwood Creek
Meadows Creek
Two Water Creek
Sohare Creek
Falls Creek
Little Sohare Creek
Dry Cottonwood Creek
Dry Dallas Creek
Deep Creek
Deer Creek
Bums Creek
Tepee Creek
Brashears Creek
Fish Creek

Table 3-4. Summary of cumulative distances, in miles, of each vegetation type that would be traversed by new road construction or major road reconstruction for each alternative.

Community Type	Alt. A	Alt. B	Alt. C (Miles)	Alt. D1	Alt. D2	No Action
Uplands:						
Sagebrush	0.0	6.0	6.0	0	0	0
Upland meadow	2.1	0.9	1.3	0	0	0
Spruce-fir	0.2	3.4	2.0	0	0	0
Mixed pine	0.6	1.5	0.9	0	0	0
Total Uplands	2.9	11.8	10.2	0	0	0
Wetlands:						
Total Wetlands	0.4	1.4	1.4	0	0	0
TOTAL	3.3	13.2	11.6	0	0	0

The vegetation of the affected area serves numerous functions including watershed stability, wildlife habitat, range forage for wildlife and livestock, visually pleasing landscapes, recreation, and commercial commodities such as firewood and timber. Stands dominated by whitebark pine are of particular importance because the trees provide forage for grizzly bears, as discussed in greater detail in the Wildlife Section. Of particular note are the wetland types, which are relatively rare in the area. Wetlands provide unique and important wildlife and fishery habitat and are integral components of riverine systems by nature of their ability to route flood waters and treat water to maintain high quality. Wetlands are protected under the Federal Clean Water Act of 1977.

No federally listed plant species, federal candidates for listing, or other rare species are known to occur within the affected environment of the proposed action or alternatives (Harms 1986, Gordan 1987, and USDA 1986).

Both the spruce-fir and mixed pine community types contain commercially valuable timber, ranging from stands of pole-sized "dog hair" lodgepole pine to old growth stands of Engelmann spruce and subalpine fir. Wildland fire, forest pathogens, and current and past timber harvest have provided a diverse mosaic of forest stands, each with a characteristic size class distribution, species composition, and successional stage. The forested areas have been delineated into compartments and subsequent

stands by the FS for inventory and management purposes. Not all stands have been inventoried for their timber resources.

Heavy loss of timber has occurred in the general area due to mountain pine beetle and dwarf mistletoe infestations. This, as well as fire suppression and exclusion, has allowed a large volume of downed fuel loads to accumulate in dense timber stands. The closest recent and current timber harvest operations are located near the confluence of Dry Lake Creek and the South Fork of Spread Creek in the northern portion of the affected area as indicated in Exhibit 3-3. Several areas within the project area have been proposed for harvest. An environmental assessment (EA) was recently prepared by the FS for the Gunsight Pass Resource Management Area timber sale (USDA 1985), which was proposed in an area in close proximity to the affected environment. This EA summarized the timber resources in the area, presented an economic analysis of several harvest alternatives, and presented an assessment of environmental impacts. A "no cutting" decision was reached by the FS in regard to this timber sale after it was determined that the timber sale would not benefit wildlife or outdoor recreation. Much of the areas considered for timber harvest are not currently accessed by existing roads.

Range livestock utilize the vegetation of the project area for forage. Two grazing allotments administered by the FS are within or adjacent to the proposed project area: Fish Creek C&H and Blackrock-Spread Creek C&H Allotments. The locations of these allotments are shown in Exhibit 3-4. The Fish Creek Allotment dominates the southern portion of the project area, and the Blackrock-Spread Creek Allotment lies mainly to the north of the project area. Both are cattle and horse (C&H) allotments and are used during the summer and early fall periods.

Most of the Fish Creek C&H Allotment is administered by the Jackson Ranger District of the Bridger-Teton National Forest and is divided into five units: South Fork-Spread Creek, Red Creek, Beauty Park-Squaw Creek, Haystack, and Breakneck. The South Fork-Spread Creek Unit lies within the Buffalo Ranger District. Each unit is grazed on a rest rotation basis, i.e., every other year. However, some grazing occurs each year in the South Fork Spread Creek and Breakneck Units. Livestock are kept within the desired unit of an allotment by topographic features, occasional drift fences, a few cattleguards, and the lack of established roads between units. Cattle are trailed through at least four of the five units each year. In 1986, the Fish Creek C&H Allotment had three permittees who were collectively allowed to run 1,865 head of cattle and 15 horses from June 11 through October 15 (USDA 1987a). This represented approximately 7,538 animal unit months (AUMs). The management plan for this allotment (USDA 1985) allows for annual use by 1,955 cattle (10,752 AUMs). The overall capacity of the allotment is approximately 19,700 AUMs (USDA 1980).

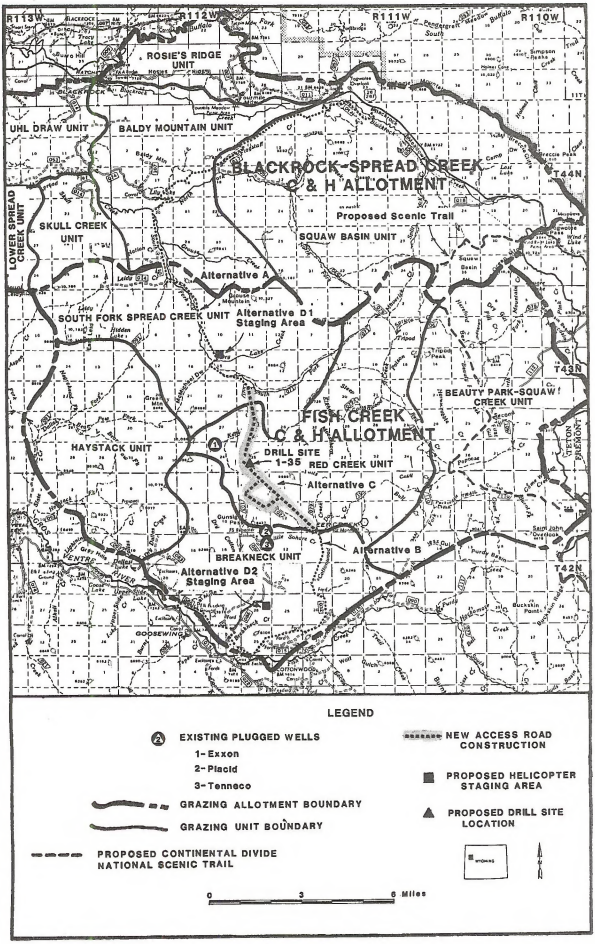


Exhibit 3-4.
GRAZING ALLOTMENTS AND UNITS IN THE PROJECT AREA.

In addition to the range allocation for domestic livestock, special allocations of the grazing resources within the Fish Creek C&H have been given to outfitters and guides for horse use and to big game for overwintering. In 1979, a "Memorandum of Understanding" between the Wyoming Game and Fish Department and the Bridger-Teton National Forest recognized the Fish Creek C&H Allotment Grazing Management Plan, which outlined special livestock management guidelines for the Breakneck and Haystack Units (USDA 1980). The Breakneck Unit lies to the south of the proposed project while the Haystack Unit lies to the west. The guidelines essentially set aside a majority of the forage in those units for big game species, primarily elk. The Memorandum also recommends improvements of the general forage areas and riparian systems on the allotment.

The Blackrock-Spread Creek C&H Allotment lies to the north of the proposed project area and is administered by the Buffalo Ranger District of the Bridger-Teton National Forest. In 1986, the allotment had three permittees who ran 1,456 cattle during June 16 through October 15. This amounted to approximately 5,824 AUMs. Use patterns and control methods are similar to the Fish Creek Allotment (USDA 1987b).

3.7.2 Drill Site

The proposed drill site is located within spruce-fir and upland meadow community types. Timber resources at this site have been characterized as being old growth (USDA 1986). Subalpine fir and Engelmann spruce co-dominate the stand with minor amounts of whitebark pine and lodgepole pine. The indicated habitat type at the drill site is subalpine fir/grouse whortleberry. The drill site is located within the Red Creek Unit of the Fish Creek C&H Allotment (Exhibit 3-4).

3.7.3 Access Alternatives

3.7.3.1 Alternative A

The existing road that would be used to access the Kettle Creek drainage traverses a mosaic of sagebrush, upland meadow, mixed pine, and spruce-fir types. Where the existing road crosses streams or parallels them closely, both wet subirrigated meadow and willow riparian types are traversed.

The segment of road requiring new construction (including previously reclaimed road along Kettle Creek) would traverse spruce-fir, mixed pine, upland meadow, and wet subirrigated meadow and riparian willow to the drill site. Approximately 80 percent of the mixed pine along this route include stands dominated by whitebark pine. The cumulative distance of each vegetation type that would be traversed by new road construction and major road reconstruction is summarized in Table 3-4.

The timber resource within the spruce-fir and mixed pine types includes primarily pole to small sawlog-sized timber with little old growth timber.

This alternative would traverse the Squaw Basin Unit, Baldy Mountain Unit, and the South Fork of Spread Creek Unit of the Blackrock-Spread Creek C&H Allotment from its divergence from U.S. Highway 26-287 to near the confluence of the South Fork of Spread Creek and Kettle Creek. At this point the new access road would cross into the Red Creek Unit of the Fish Creek Allotment and terminate at the drill site within this unit (Exhibit 3-4).

3.7.3.2 Alternative B

The existing road that would be utilized to access the Cottonwood Creek drainage traverses primarily sagebrush with some riparian willow along the Gros Ventre River and other small streams. Once the Cottonwood Creek drainage is accessed, major road reconstruction and new road construction would traverse sagebrush, some spruce-fir, and riparian willow and wet subirrigated meadow to the confluence of Sohare Creek with Cottonwood Creek. From this point, the road would parallel Sohare Creek and traverse spruce. fir, upland meadow, and wet subirrigated meadow and riparian willow to a point along Sohare Creek where the road would deviate from the drainage into spruce-fir and mixed pine types. Spruce-fir, mixed pine, wet subirrigated meadow and riparian willow, and upland meadow would be traversed to access the drill site from Sohare Creek. A minor amount (10 percent) of the mixed pine stands are dominated by whitebark pine. The cumulative distances of each vegetation type that would be traversed by new road construction and major road reconstruction are summarized in Table 3-4.

The timber resources in the spruce-fir and mixed pine types include primarily pole to small sawlog-sized lodgepole pine and small to large sawlog-sized Engelmann spruce and subalpine fir.

From its initiation at the Gros Ventre Road, this alternative would traverse the Breakneck Unit and the Red Creek Unit of Fish Creek Allotment as shown in Exhibit 3-4.

3.7.3.3 Alternative C

This access route would be very similar to Alternative B with the exception of the last 1.6 miles, where the route would continue to parallel Sohare Creek to the drill site. This segment of the road would traverse wet subirrigated meadow and riparian willow, a mix of spruce-fir and mixed pine, and upland meadow to the drill site. Much of the timber resource contained within these stands consists of old growth Engelmann spruce and subalpine fir at this predominant valley bottom and lower slope position of the

route. The cumulative distances of each vegetation type that would be traversed by new road construction and major road reconstruction are summarized in Table 3-4. The same grazing allotments and units would be traversed by this alternative as described under Alternative B.

3.7.3.4 Alternative D

3.7.3.4.1 Northern Staging Area (D1)

This staging area would be located on a terrace above spread Creek covered with sagebrush within the South Fork of Spread Creek Unit of the Blackrock-Spread Creek C&H Allotment. No timber resources occur at the staging area site.

3.7.3.4.2 Southern Staging Area (D2)

This staging area would be located on a gently sloping flat covered with sagebrush within the Breakneck Creek Unit of the Fish Creek Allotment. No timber resources occur in the vicinity of the staging area.

3.8 WILDLIFE

3.8.1 Introduction

Six primary wildlife habitat types are associated with the proposed drill site, road construction, and helicopter staging alternatives: spruce-fir, mixed pine, upland meadow, wet subirrigated meadow, riparian willow, and sagebrush. Whitebark pine dominates a portion of the mixed pine type. Typical wildlife species that occur in the area include elk, moose, mule deer, bighorn sheep, black bear, coyote, pine martin, snowshoe hare, pine squirrel, porcupine, Gapper's red-backed vole, blue grouse, goshawk, red-tailed hawk, great grey owl, western tanager, raven, grey jay, Clark's nutcracker, Cassin's finch, pine grosbeak, Oregon junco, and white-crowned sparrow.

Although the proposed drill site is not located within critical wildlife habitat, seasonal movements of elk through this area do occur. The various access alternatives leading to the drill site would pass through habitats of a number of wildlife species of special concern. These species include one federally listed threatened wildlife species (grizzly bear), three federally listed endangered species (whooping crane, bald eagle, and peregrine falcon) and one proposed FWS sensitive species (trumpeter swan). The big game species are of particularly high interest because of their importance in terms of economics and recreation. The habitats for big game species include: winter range of elk, mule deer, bighorn sheep, and moose; and elk calving habitat and migration corridors. Several peregrine

falcon perch sites and the nests of both bald eagles and trumpeter swans occur adjacent to the existing road that would be used to access the drill site from the south (Alternatives B, C, and D2). One (marked) whooping crane was observed during the summers of 1982 and 1983 in the Buffalo River Valley and the upper reaches of the Skull Creek and Spread Creek drainages. No whooping cranes have been sighted in these areas since 1983.

The area, particularly the northern portion, is year-round grizzly beer habitat, but numbers and densities are very low. The grizzly bear is classified as a threatened species, and as such, requires special management and protection on federal lands according to the Endangered Species Act. To facilitate this mandate, areas containing grizzly bear habitat have been classified by a federal interagency team into five different levels, according to their degree of importance to the bear. Each level is numbered and is referred to as a Management Situation area (MS-1 through 5), with MS-1 being the most critical and MS-5 the least critical. Two Management Situations would be involved in this project. They are summarized as follows:

Management Situation - 1

Population and Habitat Conditions. These areas contain grizzly population centers (areas key to the survival of grizzlies where seasonal or year-long grizzly activity, under natural, free ranging conditions is common) and habitat components needed for survival and recovery of the species or a segment of its population.

Management Direction. Grizzly habitat maintenance and improvement (improvement applies to Forest Service only), and grizzly-human conflict minimization will receive the highest management priority (FSM 2503). Management decisions will favor the needs of the grizzly bear when grizzly habitat and other land uses compete. Land uses which can affect grizzlies and/or their habitat will be made compatible with grizzly needs or such uses will be disallowed or eliminated.

Management Situation - 2

Population and Habitat Conditions. These areas lack distinct grizzly population centers; highly suitable habitat does not generally occur, although some grizzly habitat components exist and grizzlies may be present occasionally. By definition, Management Situation-2 areas are those considered unnecessary for species survival and recovery, although the status of such areas is subject to review according to demonstrated grizzly population and habitat needs.

Management Direction. Grizzly habitat is an important but not the primary use on the area. Habitat maintenance and improvement and grizzly-human conflict minimization may be, in some cases, important, but not the most important management considerations. Demonstrated grizzly populations and/or grizzly habitat use will be accommodated in other land use activities if feasible, but not to the extent of exclusion of other use needs.

3.8.2 Drill Site

General Wildlife. The drill site is located in spruce-fir forest and upland meadow types that do not occur within any of the areas designated as critical wildlife habitat (Exhibits 3-5 and 3-6). Summer and fall use by elk, moose, and mule deer occurs on the site and it is probable that black bear make occasional use of the drill site area. Movements of elk through the area occur during fall and late spring migration periods (Exhibit 3-7).

Species of Special Concern. It is probable that grizzly bear make occasional use of the drill site area. Clumps of whitebark pine occur in the vicinity of the site and may contribute to the fall diet of the grizzly bear.

3.8.3 Access Alternatives

3.8.3.1 Alternative A

General Wildlife. The species composition within the area proposed for Alternative A is similar to that described for the drill site. The general area through which the Alternative A access road would pass is traversed by elk during their spring and fall movements between summer and winter ranges (Exhibit 3-7). These animals winter in either the Gros Ventre drainage or the National Elk Refuge and summer in the Teton Wilderness or the higher elevation of the Gros Ventre drainage. Moose winter range is located along the North and South Forks to Spread Creek, which are crossed and paralleled by the Flagstaff Road.

Species of Special Concern. The area through which Alternative A would pass is within grizzly bear habitat. A portion of Alternative A traverses the mixed pine type, in many places dominated by whitebark pine. For the most part (80 percent) the existing and proposed road are along the boundary between MS-1 and MS-2 habitats. The MS-1 area illustrated in Exhibit 3-5 is year-round grizzly habitat. The density of bears within this area, however, is lower than in other MS-1 habitats within the Greater Yellowstone Area.

3.8.3.2 Alternatives B and C

General Wildlife. The species composition within the area proposed for Alternatives B and C is similar to that described

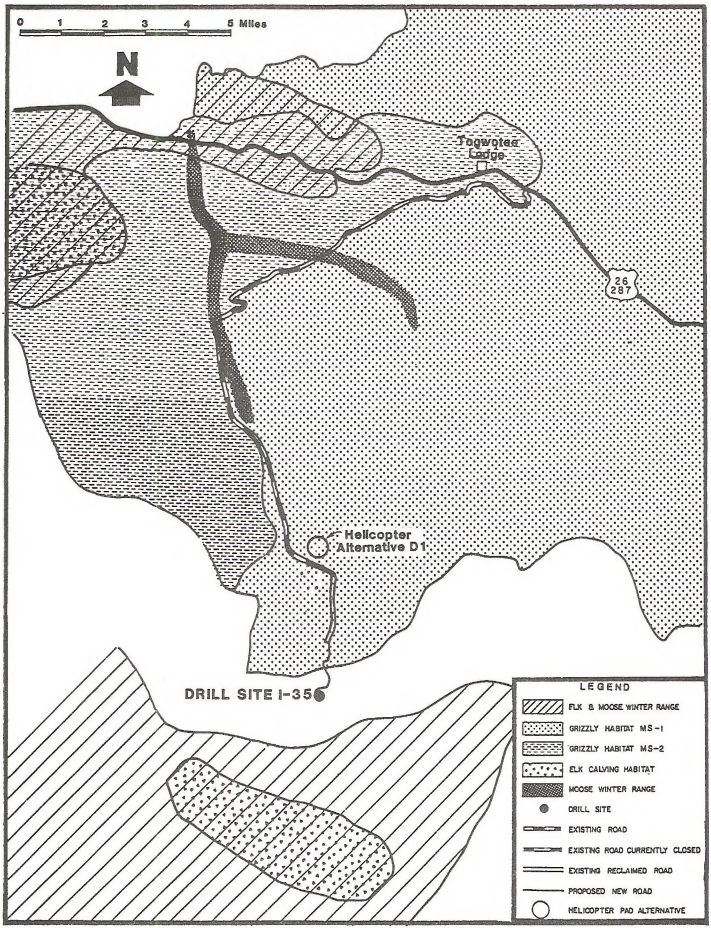


Exhibit 3-5.
ALTERNATIVES A and D1 WILDLIFE MAP.

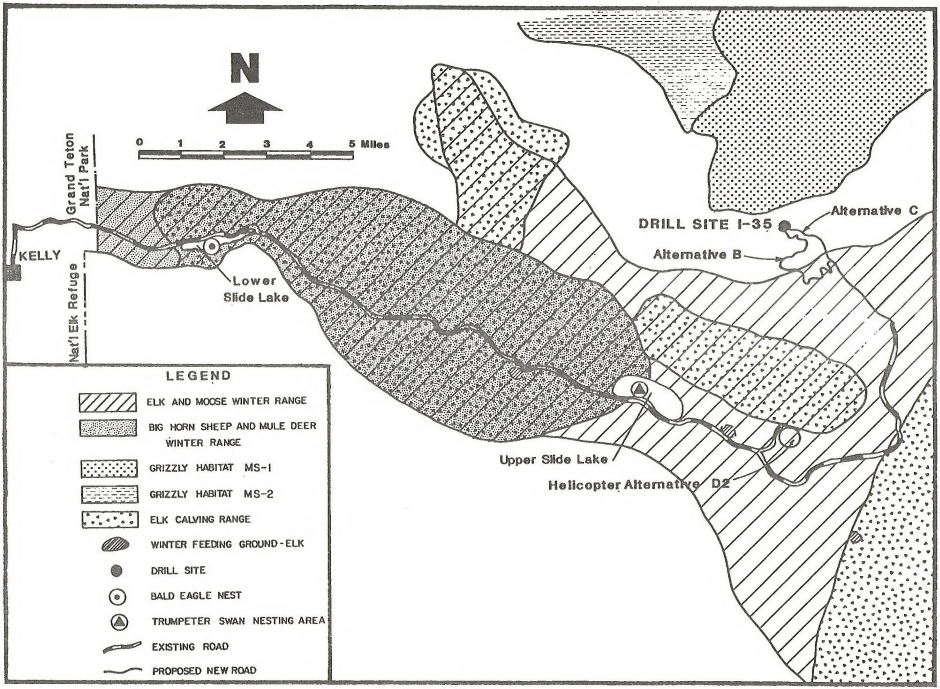


Exhibit 3-6.
ALTERNATIVES B, C and D2 WILDLIFE MAP.

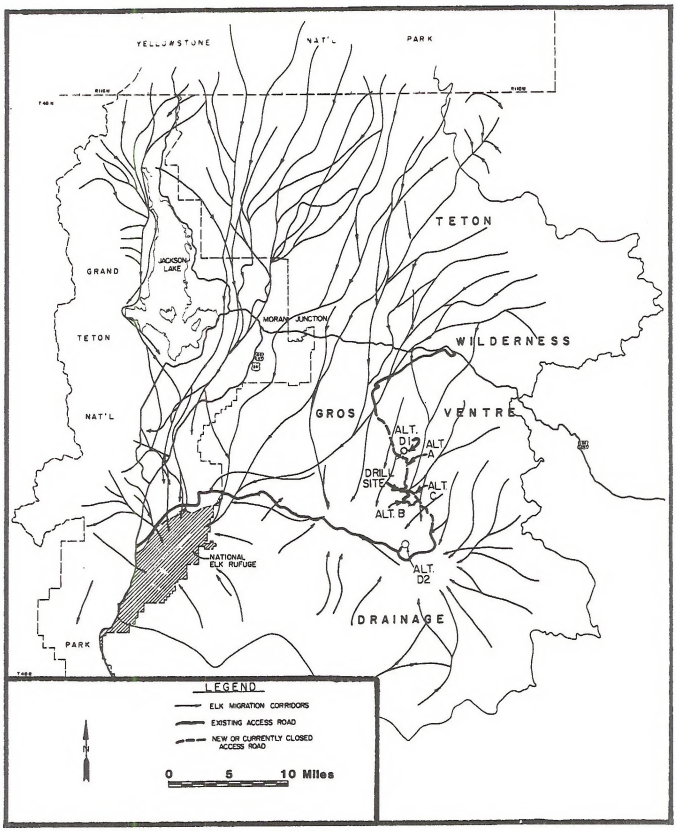


Exhibit 3-7.
ELK MIGRATION CORRIDORS

for the drill site. The southern access route alternatives would pass through habitat designated as winter range for elk and moose by the Wyoming Game and Fish Department and the FS. The existing access road into the analysis area from the south also goes through habitat designated as winter range for mule deer and big horn sheep. Elk calving areas are encountered in the lower reaches of Sohare Creek (Figures 3-5 and 3-6). The southern access route alternatives would pass adjacent to two winter elk feeding grounds operated by the Wyoming Game and Fish Department. These winter feeding grounds are utilized by approximately 2,000 elk each winter.

The general area through which access roads for all three alternatives would pass is traversed by elk during their spring and fall movements between summer and winter ranges (Figure 3-7). These elk winter in the Gros Ventre drainage and summer either in the Teton Wilderness or the Gros Ventre drainage. The extreme western portion of existing access, located within the Grand Teton National Park and along its eastern border, intersects corridors used by elk that winter in the National Elk Refuge and summer in Grand Teton or Yellowstone National Parks or the Teton Wilderness.

Species of Special Concern. Bald eagle and trumpeter swan nesting areas occur adjacent to the existing road access. During recent years, several non-breeding male peregrine falcons have been sighted in the area immediately south and west of Kelly along the Gros Ventre River.

3.8.3.3 Alternative D

3.8.3.3.1 Northern Staging Area (D1)

General Wildlife. The wildlife species inhabiting the area of concern for Alternative D1 are similar to those described for Alternative A.

Species of Special Concern. The helicopter pad and staging area sites are located approximately 3.8 direct-line miles north of the drill site in an area designated as grizzly bear habitat (MS-1). The direct-line route between the helicopter pad and the drill site would pass over 3.2 miles of MS-1 grizzly bear habitat but would not intersect any other designated high-interest wildlife habitat (Figure 3-5).

3.8.3.3.2 Southern Staging Area (D2)

General Wildlife. The wildlife species inhabiting the area of concern for Alternative D2 are similar to those described for Alternatives B and C. The helicopter pad and staging area are located approximately 4.9 direct-line miles nearly due south of the drill site in an area adjacent to a designated elk calving

habitat. The direct line route between the helicopter pad and the drill site would pass over 2.0 miles of elk calving habitat and 3.8 miles of elk and moose winter range.

Species of Special Concern. Alternative D2 would not intersect any designated wildlife habitat for species of special concern (Figure 3-6).

3.9 VISUAL RESOURCES

3.9.1 Introduction

The following description of the affected environment of the proposed drill site and alternatives access is based on the FS land area classification and delineation system for visual resources. Physiographically, the area would be classified as a Central Rocky Mountain character type. Lodgepole pine, Engelmann spruce, and some aspen dominate the more productive sites. Riparian vegetation is visually dominant along the drainage corridors. South facing slopes are open vegetated primarily with shrubs and grasses. Mountain peaks in the vicinity range in elevation from approximately 9,500 to 10,300 feet. Topographic elevation is high. In general, the area possesses the type of visual quality associated with the Central Rocky Mountains. Exhibit 3-8 shows the distribution of land areas classified by variety class, Exhibit 3-9 shows the distribution by sensitivity level and distance zone, and Exhibit 3-10 by visual quality level. Table 3-5 shows the cumulative mileage of these classifications that each alternative would traverse. (see Appendix C-2 for definitions and discussion on variety classes, distance zones, sensitivity ratings, and visual quality levels).

3.9.2 Drill Site

The proposed drill site is located in an area classified as variety class Common. This class includes areas where features contain variety in form, line, color, and/or texture but to a degree that is typical of the area. The features are not outstanding in visual quality. In regards to the distance and sensitivity ratings, the drill site is located on the outer edge of a Middleground Distance Zone with a High sensitivity rating.

The proposed site is located at the head of a small semi-enclosed basin which ultimately forms the headwaters of the Sohare Creek drainage. Due to location, elevation, and screening, the site could meet the criteria for a Seldom Seen classification. The drill site area receives very little use except for a short period during the hunting season. The quality of the visual resource is an important component of the recreational experience for site users and others recreating in this area. The only

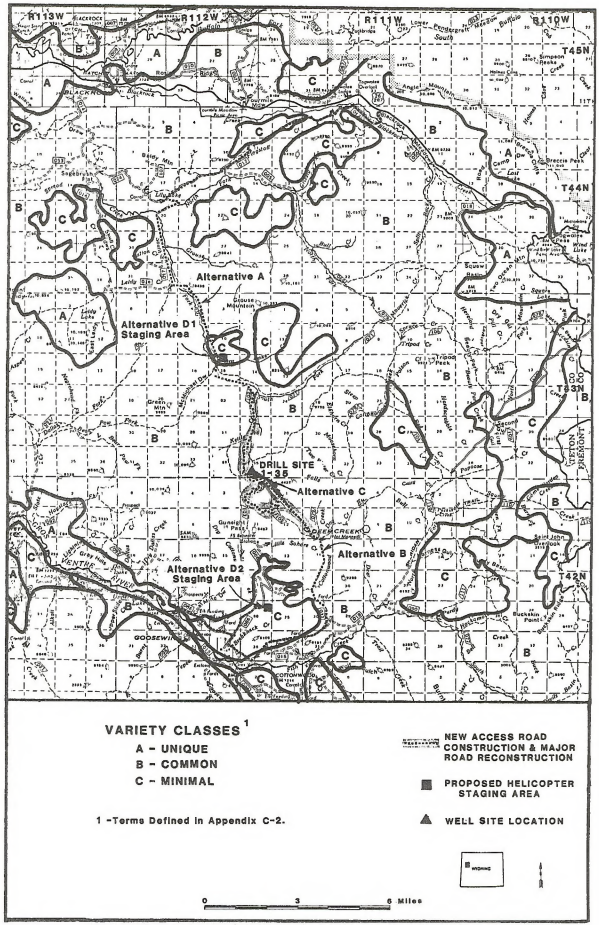


Exhibit 3-8.
VARIETY CLASSES.

Exhibit 3-9.
SENSITIVITY LEVELS AND DISTANCE ZONES.

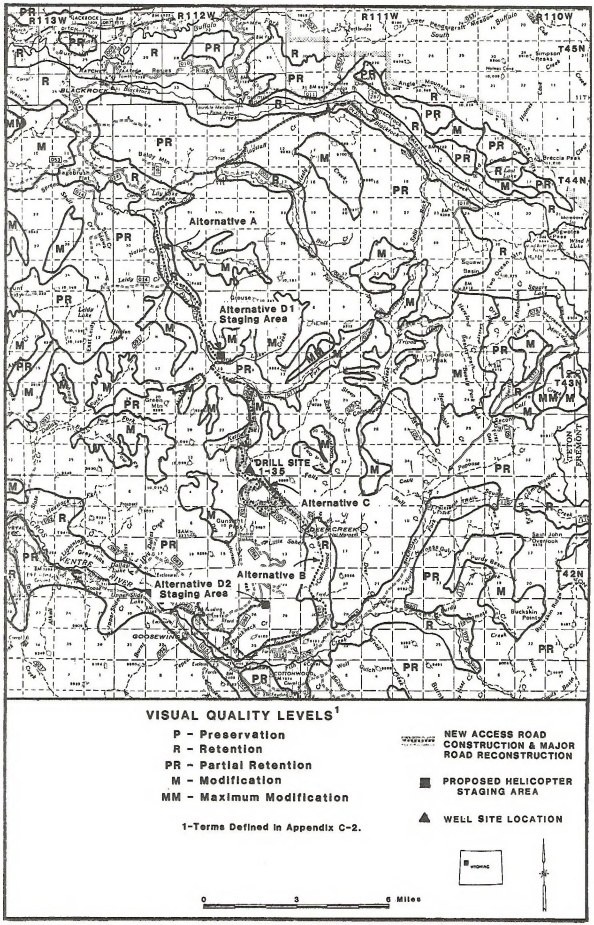


Exhibit 3-10.
VISUAL QUALITY LEVELS.

Table 3.5 Summary of miles of each category of sensitivity level, distance zones, variety class, and visual quality level that would be traversed by the access alternatives.

	Approximate Mileage[1]				
Classification[2]	Alt A	Alt B	Alt C	Alt D1	Alt D2
Variety Class					
A - Unique	0.0	15.6	15.6	0.0	15.6
B - Common	19.5	14.0	12.4	14.0	4.4
C - Minimal	2.5	3.0	3.0	2.5	3.0
Sensitivity Level					
1 - High	14.0	32.6	31.0	14.0	23.0
2 - Moderate	7.0	0.0	0.0	2.5	0.0
3 - Low	1.0	0.0	0.0	1.0	0.0
Distance Zones					
Foreground	17.0	30.6	29.0	14.0	22.0
Middleground	3.0	2.0	2.0	2.5	1.0
Background	1.0	0.0	0.0	0.0	0.0
Seldom Seen	1.0	0.0	0.0	0.0	0.0
Visual Quality Level					
P - Preservation	0.0	0.0	0.0	0.0	0.0
R - Retention	9.0	21.8	21.8	8.3	15.8
PR - Partial Retention	10.5	10.8	9.2	8.2	7.2
M - Modification	2.5	0.0	0.0	0.0	0.0
MM - Maximum Modification	0.0	0.0	0.0	0.0	0.0
UM - Unacceptable Modification	0.0	0.0	0.0	0.0	0.0
REH - Rehabilitation	0.0	0.0	0.0	0.0	0.0
E - Enhancement	0.0	0.0	0.0	0.0	0.0

1- mileage on FS administered lands only.
2- definitions can be found in Appendix C-2.

existing road with a possible view of the drill site is a jeep trail to Gunsight Pass which is one mile from the proposed drill site and screened from view by a ridgeline intercepting the line of sight.

Under the current management direction, the FS has assigned the area where the drill site would be a visual quality level of Partial Retention. This means that activities in a Partial Retention zone must remain visually subordinate to the surrounding characteristic landscape. The current management direction would permit timber harvest and other management activities that could substantially alter the existing visual resource (Jann 1987).

3.9.3 Access Alternatives

3.9.3.1 Alternative A

The Flagstaff Road portion of this route passes through variety classes no higher than Common and sensitivity ratings from Low to High. However, the majority of this portion of the route is located in sensitivity levels of Average and Low, with approximately 6 miles in High sensitivity. Most of the road from Kettle Creek to the drill site has a visual management rating of Modification or Partial Retention. Substantial timber harvest operations have and are currently taking place just north of the confluence of Kettle Creek and the South Fork of Spread Creek.

From the junction at Kettle Creek to the existing road on the South Fork of Spread Creek, the alignment would follow a previously reclaimed access road. This portion of the route has been classified as a Common variety class, Foreground Average sensitivity and Seldom Seen Low sensitivity, and a visual quality level of Modification and Partial Retention.

The section of road from Kettle Creek to the drill site would be newly constructed. Most of this section of road (approximately 1.75 miles) is located in a Background High sensitivity level, Common variety class, and Partial Retention visual quality level.

3.9.3.2 Alternative B

This route would access the drill site from the Gros Ventre Road. From this road the access would follow the existing Cottonwood Creek Road through Common variety class, Foreground High Sensitivity, and Retention visual quality levels. From Cottonwood Creek, the new road would traverse Common variety class, Background High sensitivity level, and a Partial Retention visual quality level to the drill site.

3.9.3.3 Alternative C

The visual resources of the area traversed by this alternative are the same as described for Alternative B.

3.9.3.4 Alternative D

3.9.3.4.1 Northern Staging Area (D1)

The northern staging area would be located adjacent to Dry Lake Creek north of its confluence with Spread Creek on an elevated bench. The area is open with relatively flat terrain vegetated with grass and shrub materials. This site is located in an area rated common variety, Foreground Average sensitivity level, and received a visual management rating of Modification.

3.9.3.4.2 Southern Staging Area (D2)

The southern staging area would be located adjacent to the existing Dry Cottonwood Creek Road. The site is visible from much of the Dry Cottonwood Creek drainage. Because of its proximity to lightly traveled Dry Cottonwood Creek Road, the site is rated Middle Distance and High sensitivity, Minimal variety class, and recommended as a Visual Management Class of Partial Retention.

3.10 RECREATION

3.10.1 Introduction

The proposed project area is located in the northernmost section of the Gunsight Pass Resource Management Area in the Jackson Ranger District of the Bridger-Teton National Forest. This section of the Forest is centered within a broader region characterized by a wide variety of recreation resources, including Yellowstone National Park to the north, Grand Teton National Park to the west, the Teton Wilderness to the north, and the Gros Ventre Wilderness to the south as shown in Exhibit 1-1. This region attracts extensive and diverse recreational use and visitation to both developed sites and dispersed recreation settings. The FS has delineated the Bridger-Teton National Forest into Recreation Opportunity Spectrum (ROS) classes. Each class represents a different set of recreation conditions and offerings as well as management objectives. The ROS classification system is presented in Appendix C-3. ROS delineations within the project area are depicted in Exhibit 3-11.

3.10.2 Drill Site

Forest lands in proximity to the drill site comprise a fairly large roadless area designated as providing Primitive (P) recre-

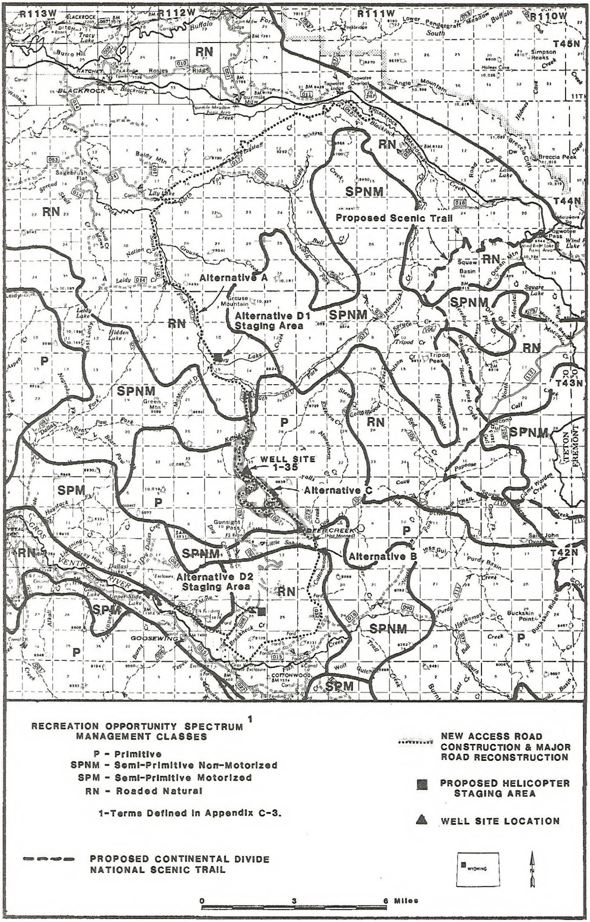


Exhibit 3-11.
RECREATION OPPORTUNITY SPECTRUM MANAGEMENT CLASSES.

ation opportunities. The drill site is located approximately 13 miles southwest of the nearest point on the boundary of the Teton Wilderness and approximately 6 miles northeast of the nearest point on the boundary of the Gros Ventre Wilderness (Exhibit 1-1). The proposed Continental Divide National Scenic Trail would be routed through an area approximately 6 miles east of the drill site.

Recreation uses in the Sohare Creek drainage area immediately surrounding the drill site almost exclusively involve big-game hunting. The Sohare drainage has been characterized as critical wildlife habitat (see Wildlife Section) and attracts substantial, but generally unquantifiable, amounts of big-game hunting use by both commercial hunting operations and non-outfitted hunters (USDA 1985). For two of the commercial outfitters authorized to hunt in the area, the Kettle and Sohare creek drainages represent the primary areas into which they take their hunters. Other commercial hunters may occasionally hunt the fringes of this drainage, as do a small number of unguided hunters.

3.10.3 Access Alternatives

3.10.3.1 Alternative A

This access route would utilize approximately 18.6 miles of existing roads within areas of the Forest designated as Roaded Natural (RN) in the ROS classification system, and approximately 3.3 miles of new road construction within the area designated as providing RN and Primitive (P) recreation opportunities as shown in Exhibit 3-11.

Recreation activities and uses in this general area of the Bridger-Teton Forest are substantial and fairly diverse, reflecting the attractiveness of the area's recreation amenities and its proximity to two National Parks (USDA 1985). Recreation activity within the specific analysis area encompassed by the Alternative A access route involves primarily dispersed uses during the summer, fall and winter months. In the area surrounding this access route, summertime recreation use includes high levels of overnight camping, hiking, day camping, sightseeing, horseback riding, all-terrain vehicle (ATV) use, and other dispersed recreation activities. Although fishing on many of the small creeks in the area is reportedly quite limited due both to the lack of easy road access and limited fishing quality, Spread Creek, Kettle Creek, and Leidy Lake all attract fishermen to the area. Commercially operated summertime and early fall recreation in the area includes horseback riding out of Togwotee Lodge. A well established trail ride/wagon train operation (Wagons West), which operates throughout the Leidy Lake and Spread Creek area, attracted a total of 1,414 users during the 1986 season. Another smaller trail ride operation attracted a total of 365 visitors.

In addition, a third commercial outfitter is in the process of establishing a business which would offer summer trail rides and wilderness recreation trips in the area (Childress 1987).

During the fall hunting season, the area surrounding this access route receives considerable big-game hunting use from both commercial hunting outfitters and individual non-guided hunters. The primary use involves elk hunters, although some moose and deer hunting also occurs in the area. Archery seasons begin in late August, with rifle season running from September 10 through October 31. Three commercial outfitters have hunting camps in proximity to the Kettle Creek access route: one on the north fork of Spread Creek east of the access route, one on Leidy Creek just west of the access route, and one on Kettle Creek immediately adjacent to the proposed access route. Several other day-use hunting outfitters also frequent this general area (Childress 1987). Overall, between 25 and 30 commercial outfitters are authorized to hunt within the area surrounding the access route, although in most years only a few outfitters tend to use the specific drainages (South Fork of Spread Creek, Kettle Creek, and Sohare Creek) which are immediately adjacent to the proposed location for the access route (Mourtsen 1987).

Winter recreation use of the area of Alternative A involves primarily private and commercial snowmobiling. Commercial snowmobiling activities are centered at Togwotee Lodge, which also provides nordic skiing facilities, overnight lodging for up to 70 guests, dining, and other on-site guest facilities. This facility employs between 25 and 28 individuals during the peak winter use season, and according to the manager of the facility attracts approximately 5,000 overnight visits during the winter (Helgeson 1987). Snowmobiling ordinarily occurs throughout the Flagstaff Creek area, as well as along the South Fork of Spread Creek drainage into a network of trails that provide access to the Gros Ventre Road and Goose Wing Ranch to the south. However, logging activity near the confluence of Kettle Creek and the South Fork of Spread Creek (Exhibit 3-3) and associated plowing of the Flagstaff Road during three of the past four winters has displaced a portion of this use, with access to the Gros Ventre--Goose Wing area restricted primarily to a system of trails that are located south and east of Togwotee Lodge. Nevertheless, snowmobiling use in the access route area has continued, due in part to the development of a trail system adjacent to the Flagstaff Road which crosses that road in three separate locations.

Although quantitative data on recreational use within the specific area of interest are not available, data aggregated for other overlapping management areas provide some indication of the amounts and patterns of recreational use occurring in the vicinity. This access route alternative would be located in an area which is encompassed by parts of areas which the FS has defined as Habitat Units 5-2 and 5-3. Overall, estimates derived

from the FS 1980 Recreation Information Management (RIM) system indicate a total of 17,000 recreation visitor days (RVDs) of use within these two units. (An RVD is one person participating in an activity for 12 hours, or 12 persons participating in an activity for one hour, or some combination thereof. An RVD is, therefore, a time measure of participation, and not necessarily an accounting of visits or visitation.) Of this use, over 81 percent was estimated to have occurred in ROS areas classified as Roaded Natural (RN), whereas less than 17 percent was estimated to have occurred in areas classified as Primitive (P) or Semi-Primitive Non-Motorized (SPNM). This reflects the tendency for most recreational use to occur in areas which are readily accessible via motorized travel on existing roads and trails, with relatively little use in more remote areas of the Forest.

3.10.3.2 Alternative B

The Sohare Creek route to the proposed drill site would follow the existing Gros Ventre Road from Kelly to the Cottonwood Creek Road, involving areas classified under the ROS system as Roaded Natural (RN) (Exhibit 3-11). Beginning on the Cottonwood Creek Road, upgraded and new road construction would involve roughly 2.5 miles through an area presently classified as RN, about 0.6 miles of road in an area classified as Semi-Primitive Non-Motorized (SPNM), and approximately 5.0 miles to the drill site within the area classified as Primitive (P) (Exhibit 3-11; also see Transportation Section).

The Alternative B area attracts considerably more recreational use than the area that would be impacted by Alternative A. Although estimates of total recreation visitor use are not available, aggregate use of this area undoubtedly exceeds 25,000. A description of this use based on existing data and personal communication with operators follows.

Data on recreational use within the Gunsight Pass resource management area provide important insights into recreation patterns in the area surrounding the drill site and the Sohare access route (USDA 1985). This area, which encompasses 43 square miles centered around Gunsight Pass, receives an estimated 2,680 RVDs of use annually. FS personnel have disaggregated this estimate of overall use into the following general categories:

Big game hunting:	860 RVDs
Night camping:	700 RVDs
Day camping:	400 RVDs
Ice and snow travel:	300 RVDs
Horseback riding:	240 RVDs
Hiking and walking:	180 RVDs

These data clearly reflect the importance of big game hunting as a predominant recreation use of the Gunsight Pass management

area, which includes the drill site and access route areas lying north of the Gros Ventre Road. However, it is important to note that these estimates do not include the significant snowmobiling use along the Gros Ventre Road immediately to the south.

Recreational activities in areas adjacent to or near this access route involve a combination of developed-site and dispersed uses. The FS maintains three developed campgrounds along the Gros Ventre Road between the end of the pavement near the Atherton campground and the Cottonwood Creek Road turnoff: Atherton Creek, Red Hills, and Crystal Creek. Summer and fall use of these facilities is substantial, involving campers in search of less-developed and less-crowded areas than those available in the National Park, as well as hunters who use the areas for preseason scouting trips and during the big-game hunting seasons. During the 1986 season, the Red Hills campground attracted 2,500 RVDs; Crystal Creek attracted 3,400 RVDs; and Atherton Creek attracted 11,500 RVDs (Mourtsen 1987).

In addition to campground visitation, the area surrounding the Gros Ventre and Cottonwood Creek Roads attracts a variety of dispersed summertime recreation uses. Overall use of this area is substantial, although FS visitation estimates are not available to quantify that usage. Both individual and commercial horseback riding and trail ride activities occur in the vicinity, although levels of use are apparently not high. Individuals and at least one commercial operator also use roads and trails in the area for ATV recreation. Low to moderate levels of hiking, picnicking, sightseeing, and other dispersed uses also occur in and around this part of the Forest. Fishing on the Gros Ventre River and on Cottonwood Creek attracts significant numbers of fishermen to the area (Thune 1987), although pressure does not appear to be heavy. In addition, there are several seasonal residences along the Gros Ventre Road. The presence of an approved but as-yet undeveloped subdivision adjacent to the Goose Wing Ranch indicates a potential for significant future increases in the numbers of vacation homes and cabins in this area (Mourteen 1987).

During the fall hunting season, the area surrounding this access route attracts considerable use by both commercial outfitters and non-outfitted hunters. Most of this activity involves elk hunters, although some moose and deer hunting also occurs in the area. Overall, between 25 and 30 hunting outfitters are authorized to hunt in the unit which includes the Cottonwood and Sohare Creek areas. Although most of these permittees rarely if ever use this specific area, there are two commercial outfitters with permanent camps in this area: one located on Slade Creek about 6.0 miles southwest of the drill site (Lloyd 1987); the other located at the confluence of Sohare, Little Sohare, and Cottonwood creeks, immediately adjacent to the Alternative B access route (Thune 1987). Only the latter outfitter uses the Sohare drainage as his primary hunting area. However, one other outfit-

ter permitted for day use who operates a camp on Fish Creek about 6.0 miles southeast of the drill site also uses a hunting area that overlaps into the Sohare drainage (Lutz 1987).

Winter recreation use in the area involves primarily private and commercial snowmobiling. Although no reliable data are available to estimate overall snowmobiling activity, information provided by the primary commercial operators suggests that use is heavy. Most snowmobiling in this area is concentrated along the Gros Ventre Road, with many snowmobilers departing from the point where plowing ordinarily ends, near Lower Slide Lake. The hub of snowmobiling in this area is the Goose Wing Ranch, located on the Gros Ventre Road within a mile of its junction with the Cottonwood Creek Road. The manager of this facility estimates that it attracts a total of 3,000 to 4,000 visitors during a typical winter season, including both overnight guests and pass-through snowmobilers who stop for lunch or dinner (Clark 1987). Although much of this use involves individuals and parties who are not linked to any other commercial operators, substantial numbers of snowmobilers originating from Togwotee Lodge travel into this area. In addition, there are four commercial snowmobiling permittees based in Jackson who use this area. One of the largest of these operators estimated that commercial operators outfit a total of 800 to 1,000 snowmobilers using the Gros Ventre area per season, with his share involving between 150 and 200 individuals (Goetz 1987). In addition to this snowmobiling use, limited nordic ski touring occurs in the area, including one small commercial operation located at the Darwin Ranch, several miles east of the junction of the Gros Ventre and Cottonwood Creek Roads.

3.10.3.3 Alternative C

Recreation resources associated with this alternative would be similar to those specified under Alternative B. The only change would involve a different routing of the road section between the end of the Cottonwood Creek Road and the drill site. This modified route would occur in areas with the same recreation resources and activities as those described under Alternative B. Consequently, the affected environment would be the same as discussed in the preceding section.

3.10.3.4 Alternative D

3.10.3.4.1 Northern Staging Area (D1)

The northern helicopter access staging area would be located on a flat bench immediately north of Kettle Creek, just on the boundary of the area identified as Primitive (P) in the ROS classification system. Road access to the helicopter pad area would involve routes identical to those specified to that point under Alternative A.

Helicopter flight paths between the staging area and the drill site would involve essentially the same area and recreation resources as described for Alternative A. Helicopters would probably utilize drainageways when loaded, en route to the drill site, but would probably fly at or above the elevation of nearby ridgelines when returning empty and would be audible and visible over a wider area. Consequently, for the purposes of the recreation analysis, the affected environment for staging area D1 is no smaller than that described for Alternative A.

3.10.3.4.2 Southern Staging Area (D2)

The southern helicopter access staging area would be located approximately 2.3 miles west of the confluence of Sohare, Little Sohare, and Cottonwood creeks in an area designated as Semi-Primitive Non-Motorized (SPNM) in the ROS classification system. This helicopter pad would be accessed via an existing road which intersects the Gros Ventre Road about 2 miles west of the Cottonwood Creek/Gros Ventre Road intersection, and which traverses ROS areas classified as Roaded Natural (RN) and SPNM.

Helicopter flight paths between the staging area and the drill site would involve essentially the same area and recreation resources described for Alternative B. However, helicopters would at times fly at or above the elevation of nearby ridgelines and would be audible and visible over a wide area. Consequently, for the purposes of the recreation analysis, the affected environment for staging area D2 is no smaller than that described for Alternative B.

3.11 SOCIOECONOMICS

3.11.1 Introduction

The affected socioeconomic environment for the proposed drill site and access routes lies within an area defined by the FS as the Jackson Hole Human Resource Unit (HRU). The social and economic characteristics of the town of Jackson and other nearby communities are closely linked to the recreational opportunities of the area, and the tourist industry which has developed as a result of the natural amenities of the area and its proximity to Yellowstone and Grand Teton National Parks (USDA 1985). Indeed, recent FS analyses of the socioeconomic characteristics of the Jackson Hole HRU indicated that tourism dominates the economic base of the area (USDA 1986). Tourism provides a majority of total employment in the Jackson Hole HRU and has contributed to steady growth of population in the area. Teton County, which comprises the majority of the Jackson Hole HRU, had an estimated population of 12,099 permanent residents in 1985, which repre-

sents an increase of about 27 percent over the 1980 population of 9,509 (USDA 1986).

Consistent with the importance of recreation and tourism, there is a large segment of the population in the Jackson Hole HRU that exhibits considerable interest in and concern about the management and use of the surrounding National Forest and National Park lands. As a result, there has been active and widespread public response to a variety of proposed developments within either National Park or National Forest areas in recent years. Examples of proposals which have generated considerable local controversy and response include the proposal to modify or replace the Jackson Lake Dam within Teton National Park, the Red Creek-Cottonwood timber sale, the proposed Gunsight Pass timber sale, the proposed Bull Creek-Harness Gulch timber sale, and several previous oil and gas well proposals.

Just to the east of the Jackson Hole HRU, and in proximity to the proposed drill site and access route, is the Wind River HRU, which includes Fremont County and the town of Dubois. Although this area is also closely linked to the tourism and recreation-related development of the region, it is also characterized by considerable reliance on extractive natural resource industries, including timber harvesting and processing, livestock operations, and energy resource developments (USDA 1986). Continued declines in the timber and livestock industries have in recent years increased the relative importance of both tourism and energy development as major components of the Dubois area economy. Overall, these diverse development trends have resulted in relatively little population change in recent years. The 1980 population of Dubois was 1,067. By 1985, the population of this town had grown to 1,130, an increase of 5.9 percent over this five-year period (USDA 1986).

3.11.2 Drill Site

There are no permanent human settlements in the immediate vicinity of the drill site since it is located entirely within the National Forest boundaries. A few commercial hunting outfitters utilize the Kettle Creek and Sohare drainage (see Recreation Section).

The nearest major town is Jackson, Wyoming, located approximately 29 air miles southwest of the drill site. The community of Dubois, Wyoming, is located approximately 32 air miles southeast of the drill site. The relative proximity of these towns to the drill site suggests that potential off-site socioeconomic effects of the proposed exploratory well could be experienced in both the Jackson Hole HRU and the Wind River HRU.

3.11.3 Access Alternatives

3.11.3.1 Alternative A

There are no permanent human settlements in the immediate vicinity of this access route since it is located entirely within the National Forest boundaries. Approximately 2 miles to the west of the point where the access route intersects U.S. Highway 26-287 is the Togwotee Lodge, a tourist lodge and recrea- tion operation which attracts both summer and winter use. Several commercial hunting and recreation outfitters maintain seasonal camps within relatively close proximity to the proposed access route (see Recreation Section).

The nearest major town is Jackson, Wyoming, located approximately 38 air miles southwest of the point where the proposed access route intersects U.S. Highway 26-287. The community of Dubois, Wyoming, is located approximately 33 miles southeast of the access route intersection of U.S. Highway 26-287. The relative proxim- ity of this access route to both of these towns suggests that potential off-site socioeconomic effects of the proposed exploratory well could be experienced in both the Jackson Hole HRU and the Wind River HRU.

3.11.3.2 Alternative B

This access route falls within the Jackson Hole HRU in Teton County, Wyoming. The Town of Jackson is approximately 27 air miles southwest of the point where the Cottonwood Creek Road section of the access route intersects the Gros Ventre Road.

This alternative would involve development in the vicinity of established human populations. There are a total of 12 ranches and lodge operations located along the Gros Ventre Road between Lower Slide Lake and the vicinity of the intersection of the Cottonwood Creek Road. Two of the ranches in this area maintain control of sections of the Gros Ventre Road right-of-way, although in both instances the road has remained open to public use. Several of the operations in this area are traditional working cattle ranches and year-round residences, while several others are now involved almost exclusively in recreation and tourist activities. Also located in this area are several seasonal hunting camps operated by commercial outfitters (see Recreation Section). An approved but as-yet undeveloped recreational home subdivision adjacent to the Goose Wing Ranch portends further recreational development of this area in the coming years. Consequently, the lifestyles which characterize this small, localized population reflect a mix of both traditional ranching cultures and the more recent influences of recreational development.

This access route is linked socioeconomically almost exclusively to the Jackson Hole HRU, due both to proximity and road access. General socioeconomic characteristics of the Jackson Hole HRU discussed previously are therefore also descriptive of the broader socioeconomic environment which would potentially be affected under Alternative B.

3.11.3.3 Alternative C

The general and localized socioeconomic conditions which are relevant to the area potentially affected under this alternative are identical to those discussed in the context of Alternative B.

3.11.3.4 Alternative D

3.11.3.4.1 Northern Staging Area (D1)

The potentially affected socioeconomic environment for the D1 staging area would be the same as that described under Alternative A.

3.11.3.4.2 Southern Staging Area (D2)

The potentially affected socioeconomic environment for the D2 staging area would be the same as that described under Alternative B.

3.12 CULTURAL RESOURCES

3.12.1 Introduction

A Class I General Archeological Overview was performed on the Sohare Creek Unit for Amoco Production Company. Only one archeological site has previously been recorded for the entire 29 sections despite a number of broad surveys. A review of the recent literature indicates a higher probability for sites exists in some mountainous areas than has previously been assumed. Recent studies reveal an emerging model of cultural behavior in the Northern Bridger-Teton area. The model is discussed and suggestions offered for its testing on the Forest in the Class I Archeological Overview.

Generally, Class I archeological studies for particular project areas are limited to the project area alone. Work that has previously been done in the area is enumerated, and based on that previous work, judgments on the necessity for additional surveys are attempted. Usually it is concluded either that the lack of information is so great that additional study is necessary or that the area has been previously disturbed to the point that nothing of value would likely be located through additional research.

3.12.1.1 Prehistoric Period

The prehistoric and historic cultural setting of the project area can best be understood from the chronological perspective. Early human presence in the general vicinity of the project area can be dated to between 14,500 to 7,750 B.P. (before present, using 1950 A.D. as a base date). These are not dates from the Jackson Hole area but rather from adjacent regions (McDonald 1983). Similar artifacts have been found which can be used for cross dating. The earliest inhabitants are usually referred to as "Big Game Hunters" or the period in time called the "Paleo-Indian Stage." These populations are thought to have survived by hunting a rich and diversified fauna associated with the end of glaciation in North America. They made elaborate fluted projectile points labeled Clovis and Folsum that are thought to be associated with thrusting spears. The end of the stage is marked by less elaborate but more diversified projectile points labeled the "Plano Complex," which seems to indicate the beginnings of specialization to modern environmental conditions. The Mountain Archaic is delineated in time by smaller, stemmed, side or corner notched varieties of projectile points. The only reported finding associated with early man near the project area is a tantalizing but vague reference by Frison (1975) to a Folsum Point find along the Gros Ventre River. Until there is further substantiation of early man in the Jackson area, the probability of encountering these types of remains in the project area can only be considered extremely remote.

Recent studies begun by Wright in the early 1970s in Grand Teton and Yellowstone National Parks are revealing new information about mountain adaptation. Wright's concern has been to develop a deductive model of "high country adaptation" (Wright et al. 1980). The basic model of high country adaptation that has emerged portrays a seasonal round of behavior based upon the availability of certain resources. Resultant sites would be of two general types: Base camps and special function sites. They would be centrally located in regard to the varied activities of the group. Special function sites would be smaller, with fewer artifacts, and would reflect specialized procurement activities of either food or raw materials. Base camps would act as a centripetal force in the seasonal rounds.

The work of Bender (1983) elucidates the higher elevation segment of Archaic Period Behavior. Bender's study of the Northern Tetons focused on an area above 8,000 feet that was thought to be significant but largely ignored from an archeological standpoint. Five base camps were located, three of which were near to ecotones with ponds while two others were closer to sources of raw material (ignimbrite) than to water. A dichotomy was seen between the larger base camps and the secondary camps. The latter being used more than sporadically than by smaller groups

during their nomadic rounds. Special use sites were found in areas with either base or secondary camps. Adjacent areas, which had the same abundant resources, were found to have virtually no evidence of occupation. The study's primary significance is that it shows a well developed pattern of behavior that persists over time in a high elevation environment
that was once seen to be archaeologically marginal. Certain aspects of this study revealed that there are preferred mountain habitats.

The question arises as to whether or not the drainages within the Sohare Creek Unit are "preferred mountain habitats." The existing data base does not seem to support that contention. One known site in 29 sections, despite numerous surveys, promotes a low probability rating for the remainder of the unit. But as in much of the Forest, there is simply too little information to make a definite conclusion. If further survey, particularly near the mouths of the drainages, fails to reveal any sites, particularly base camps, then the probability of other sites will decline dramatically.

The Mountain Archaic was the primary culture stage for most of the prehistoric period on the Bridger-Teton. We do not begin to see significant change until about 1700 A.D. when the Shoshone expansion out of the Great Basin begins to reach the Jackson area (McDonald 1983). These populations, with a more efficient processor-type economy, replaced the high country adaptation.

3.12.1.2 Proto-Historic and Historic Periods

The Proto-Historic period begins when European influences began to have a major effect on the Native American life-style. Changes were rapid, pronounced, and irreversible. The first significant change was the Shoshone expansion from the Great Basin after they acquired the horse somewhere around 1700. The Shoshone with their superior food processing economy expanded into much of the Western Wyoming Basin and even went further north into Montana.

The Shoshone held sway until about 1810 when the displaced Crow, with not only the horse but also firearms, displaced the Shoshone. Their domination was short-lived, however, as the stronger Blackfeet began to raid as far as the Great Salt Lake. The Blackfeet did much to obliterate the bison on the high Plains and in the Great Basin. When the bison were gone the Blackfeet began to raid the Trappers and Shoshone for horses. This particular raiding pattern produced an alliance between Trappers and Shoshone that allowed them to drive the Blackfeet back to Montana (Senulis 1969). Periodic skirmishes between bands of various tribes occurred in the Jackson area. The onslaught of Euro-American populations beginning in the 1840s witnessed the end of the power of the Native Americans.

The advent of the historic period in the general area can be dated to the time of the establishment of Yellowstone National Park by the Forest Reserve Act of 1891. Yellowstone was the first National Park in the United States. The railroad was extended to Yellowstone in 1907 and opened adjacent areas near Jackson Hole to ranching. There is much to be written on the history of the area and this should be a priority in future research.

3.12.2 Drill Site

Cultural resources occur in some high altitude locations. A Class III cultural resource inventory would be necessary to determine if cultural resources occur in the project area.

3.12.3 Access Alternatives

Cultural resources occur in some high altitude locations. A class III cultural resource inventory for each of the access alternatives would be necessary to determine if cultural resources occur in the project area.

3.13 LAND USE CONSTRAINTS AND CONFLICTS

3.13.1 Introduction

The document which currently directs management of the project area is the Bridger-Teton National Forest Spread Creek-North Gros Ventre Final Environmental Statement and Land Management Plan (March 1974). The Amoco drill site proposal is located in Management Area No. 2, Fish Creek, and Management Unit 2-4, Alpine Forest and Range Lands. Management direction and decisions applicable to the drilling action in Management Unit 2-4 are summarized in Appendix C-5.

Presently, however, the Bridger-Teton National Forest Management Plan is being revised. The proposed "Land and Resource Management Plan" (October 1986), or new Forest Plan, is currently in draft stage. Although management direction contained within the draft document cannot be used or required for the Amoco drilling proposal, it is important to be aware of the proposed management. The reason for this is so that the agency officials will be aware of the extent to which one may affect/conflict with the other. Proposed management prescriptions applicable to the proposed drilling action area are also broadly discussed in Appendix C-5.

The proposed drill site would be located within FS land that has been inventoried and classified according to various resource management criteria and is consistent with existing management prescriptions. Details on the inventories and classifications are found in the appropriate preceeding resource sections. Table 3-6 lists the resources and identifies the source plans or

Table 3-6. Land use plans, inventories and management strategies for natural and man-made resources relevant to the proposed Sohare Creek Unit Exploratory Well Site.

Resource	Existing Plans or Management Criteria
Minerals	Previous exploration surveys; federal and state surveys, administrative and legal frameworks
Air	Clean Air Act, state and federal surveys and legal framework
Transportation	Federal and state road surveys and management plans, B-TNF* traffic regulations, National Scenic Trail management plan
Soil	Soil Conservation Service surveys and management recommendations, other state and federal surveys, Gas/Oil exploration surveys
Water	Clean Water Act, state surveys, USGS and SCS surveys and gaging stations
Fisheries	Wyoming Fish and Game surveys and comprehensive species plans, B-TNF surveys
Vegetation/Timber	B-TNF inventories and management plans
Wildlife	Wyoming Game and Fish and B-TNF surveys, inventories, and management plans; FWS surveys, guidelines for T&E species and Endangered Species Act
Visuals	Visual Quality Level surveys and classifications by B-TNF
Recreation	Recreation Opportunity Spectrum surveys by B-TNF
Socioeconomic	B-TNF censuses and surveys, National Census Bureau surveys
Cultural	B-TNF and other federal and state surveys, state and federal Antiquities Acts

*Bridger-Teton National Forest

surveys used in determining their use and management. Land use conflicts and constraints are then defined wherever the proposed action for the Sohare Creek Unit Exploratory Well Site No. 1-35 conflicts with these management plans or regulatory constraints.

CHAPTER 4

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter of the EIS provides an analysis of the potential environmental consequences that would result from implementation of the Proposed Action or the alternatives. This includes the project components (access roads, drill site, well drilling, and helicopter access and staging areas) and development phases (construction and operation) associated with Amoco's proposed exploratory well and of producing hydrocarbons from the one well, except under helicopter access (Alternative D). Certain measures that would avoid or reduce impacts have been included by Amoco in their proposal as discussed in Chapter 2. The following impact assessment takes these measures into consideration. Where no mitigation measures have been proposed by Amoco, all significant impacts are identified assuming no mitigation. Additional mitigation, beyond the measures proposed by Amoco in Chapter 2, are identified in Chapter 6.

Since implementation of the No Action alternative would leave the existing environment unchanged with no impacts over and above those already occurring, this alternative is not discussed specifically under each discipline. The No Action alternative is discussed in Section 4-15.

Additional technical detail on the affected environment and environmental consequences is available in the resource specific technical reports located at the Bureau of Land Management (BLM) Rock Springs District Office, and the Forest Service (FS) District and Supervisor's offices in Jackson and Moran, Wyoming.

The description of the environmental consequences for each resource section in this chapter include the following subsections: **Introduction** - describes the type and range of potential impacts that could occur as a result of project implementation; **Impact Significance Criteria** - identifies the threshold or magnitude at which an impact would be considered significant, thus warranting special attention such as special mitigation; **Direct and Indirect Impacts** - area-specific and site-specific assessment of impacts; **Impacts Summary** - comparison of direct and indirect impacts that would occur under each alternative; **Cumulative Impacts** - impacts likely to occur due to this project being combined with other on-going activities and recently constructed projects, as well as projects likely to be implemented in the near future; **Mitigation Summary** - measures that could be applied to avoid or reduce impacts to levels not considered significant; and **Unavoidable Adverse Impacts**-significant impacts that are unavoidable and cannot be mitigated,

and therefore would remain throughout the duration of the project and to some point beyond.

Where the proposed action would conflict with the current management direction as provided by the Spread Creek-North Gros Ventre Planning Unit (USFS 1974), management consistency criteria are presented to identify whether a management conflict exists. These criteria are listed under each resource, where applicable.

The scope of the cumulative impacts discussion has been based on the following activities, which impose varying levels of impact on the natural resources: the residual disturbance of the three previous exploratory oil and gas wells (Tenneco, Placid, and Exxon) as shown on Exhibit 2-1, which were drilled and subsequently plugged; the on-going timber harvest operations in the South Fork of Spread Creek drainage as shown in Exhibit 3-3; the on-going winter snowmobiling activity along the Flagstaff and Gros Ventre Roads and area in between; the fall hunting activity, summer camping and fishing activity with over 17,000 recreation visitor days (RVDs) associated with the northern alternatives and over 25,000 RVDs associated with the southern alternatives; and the on-going livestock grazing. A more comprehensive discussion on impacts that are part of the existing environment is included in the No Action Alternative discussion Section 4.5.1.1.

4.1 GEOLOGY/PALEONTOLOGY

4.1.1 Introduction

Impacts that could occur within the project area fall into two general categories: 1) impacts to the geologic environment caused by project construction and operation; and 2) impacts to project facilities (including access roads) as a result of inherent geologic hazard or risk in the project area. Impacts to the geologic environment include alteration of existing topography, altering or otherwise damaging other mineral leases which may occur in the project area, initiation of landslides and mass failures, or destruction of paleontologic remains. Impacts that could occur to the project primarily include inherent geologic risk or hazard such as damage to project facilities due to earthquake, landslides, and mass failures and movement of earth material.

4.1.2 Impact Significance Criteria

Impacts were considered significant if:

Geologic Hazards:

- Earthquake induced strong vibratory ground motion capable of damaging project facilities occurred during project con-

struction or operation, exposing workers and public to abnormal levels of safety risk or hazard.

- Avalanches, landslides, or debris flows occurred independently of project construction and operation which could result in damage to project facilities, and abnormally increased worker and public safety hazard.

Geologic Environment:

- New and/or reactivated landsliding occurred due to geomorphic changes resulting from project construction causing significant resource damage and/or affect to worker and public safety.

- Large scale topographic alteration occurred causing other related impacts such as on the visual resource.

- The destruction of paleontologic remains which would substantially add to the body of knowledge on paleontologic resources in the area.

4.1.3 Direct and Indirect Impacts

4.1.3.1 Drill Site

No geologic resources would be significantly impacted by construction and operation of the proposed drill site. No fossils of significance are expected to be encountered at the drill site. The proposed drill site is located within a Zone 2 seismic risk area but on the edge of Zone 3 area. However, wells are little affected by seismic (earthquake) activity. The risk associated with a Zone 2 area corresponds to that of the central northern California oil and gas fields. After numerous earthquakes, no significant damage to wells has occurred in that region.

There is no indication of moderate to high landslide or mass failure potential in the immediate vicinity of the site, and there is a low avalanche hazard at the site.

4.1.3.2 Access Alternatives

No geologic resources would be significantly impacted by construction and operation of the proposed access route or access alternatives. No fossils of significance are expected to be encountered. The potential exists for seismic activity that could cause landslides or road subsidence in the project area, resulting in temporary closure of access roads. However, the probability of such an event is low. The presence of existing landslides or mass failures is discussed in detail in the Soils Section.

4.1.4 Impacts Summary

The most significant potential impact would be the potential for loss of human life or serious injury caused by an avalanche at the drill site. However, the probability of such an event occurring is low. Potential for impacts to project facilities or to worker or public safety as a result of seismic activity is low. Avalanche, landslide, and possible road subsidence resulting in temporary closure of access roads would be the most likely impact of seismic activity. Construction of new roads or major reconstruction of existing roads may traverse existing landslides or areas of moderate to high instability potential as discussed in greater detail in the Soils Section.

4.1.5 Cumulative Impacts

The implementation of any of the alternatives is not expected to significantly add to impacts that have occurred due to similar development projects in the area as itemized in Chapter 4.0.

4.1.6 Mitigation Summary

Snow gauges and monitors could be installed to warn of near-threshold avalanche conditions and thus to minimize or avoid impacts due to geologic hazards caused by falling rock or landslide. Cannons could be used to reduce snow loading and thus minimize the chances of an avalanche occurring. Measures to ensure no uphill loose rock exist and that all cuts are fully stabilized should be required.

4.1.7 Unavoidable Adverse Impacts

Seismic activity in the area could cause landslide or road subsidence resulting in temporary closure of access roads. However, the probability of such an event occurring is low.

4.2 AIR QUALITY

4.2.1 Introduction

Air Quality could be impacted as a result of project construction and operation in the following ways: 1) suspended particulate matter generated from the road, drill site, and well construction activities; 2) accidental emissions of pollutants such as sulphur dioxide or hydrogen sulfide during exploratory well drilling or during the production phase of the project; 3) accidental spills of volatile petroleum products; or 4) emissions from construction machinery.

4.2.2 Impact Significance Criteria

The following criteria were used to determine the significance of impacts to air quality that could result from project implementation. Impacts to air quality would be considered significant if:

- The accidental emission of hydrogen sulfide, sulfur dioxide, or other harmful compounds in sufficient concentrations and duration to affect the health and safety of workers at the site or other forest visitors in the vicinity.

- The emission of pollutants from any activities associated with the construction and operation of the proposed project exceed the concentration threshold values set by the prevention of significant deterioration (PSD) and ambient air quality standards mandated by the State of Wyoming Air Quality Division Rules and Regulations.

4.2.3 Direct and Indirect Impacts

The proposed project would not be expected to cause significant impact to the air quality of the affected environment or the region. Suspended particulate and equipment-generated pollutants would be temporary. Dispersion rates of pollutants generated by the project, as well as air circulation patterns characteristic of the area, would be sufficient to preclude development of concentrations in excess of the standards (ambient and prevention of significant deterioration) set by the State of Wyoming Air Quality Division Rules and Regulations. The only significant impact would be an accidental emission of sulfur dioxide or hydrogen sulfide during drilling. However, the potential of such an occurrence is considered negligible because of the 44 wells drilled in Teton County, only 2 showed marginal indication of the presence of hydrogen sulfide gas.

4.2.4 Impacts Summary

No significant impacts to air quality are expected as a result of project implementation.

4.2.5 Cumulative Impacts

The implementation of this alternative is not expected to add significantly to impacts that have occurred or that may occur to air quality due to other on-going activities in the area.

4.2.6 Mitigation Summary

Road watering, or use of magnesium chloride water on roads, would prevent or minimize dust or suspended particulate problems.

Although a negligible possibility, Amoco is required to and has prepared an Emergency Contingency Plan for evacuating the site and for taking corrective action. A copy of that plan is found in Appendix D.

4.2.7 Unavoidable Adverse Impacts

No unavoidable adverse impacts to air quality are expected to result from project construction and operation in either short-term or long-term time frames.

4.3 TRANSPORTATION

4.3.1 Introduction

The major impacts to transportation resulting from any of the alternatives involve a change in traffic volume, change in service levels, and a change in road safety in terms of accidents and road capacity.

4.3.2 Impact Significance Criteria

Significant impacts would be those that:

- Increase the road traffic volume to a level that would result in a decrease in driver comfort (operating Level of Service) for more than one recreation season or one year.
- Increase the vehicle miles of travel causing a vehicle accident probability increase of greater than 5 percent.
- Involve construction on slopes greater than 40 percent where road construction, operational slope stability, and/or reclamation cannot be accomplished without causing slope instability, stream sedimentation, and unsuccessful reclamation. Also included would be the inherent increase in worker hazards on steep slopes.
- Increase the road density on the National Forest by more than 5 percent.

4.3.3 Direct and Indirect Impacts

4.3.3.1 Drill Site

The drill site would be located near the convergence of two pack trails utilized by recreationists. These trails would be adversely impacted by construction of the drill site, and if the well were to prove productive, the impact would continue for the life of the project. For more detailed information, refer to the

Recreation Section. Winter plowing and drilling activity could generate vibrations sufficient to set off an avalanche.

4.3.3.2 Access Alternatives

An increase in traffic volume would occur under all of the alternatives. During the period of road maintenance and construction, drill site and resident camp site construction, traffic volume would average 15 vehicles per day (vpd), round trip, with peak days of 30 vpd. Construction of roads across sideslopes in excess of 40 percent could increase inherent risks to workers, as well as during travel on these road segments due to debris fall. During periods of erecting and dismantling drilling equipment and the resident camp, traffic volume would average 10 vpd, round trip, with peak days of 20 vpd. During drilling operations, traffic volume would average 5 vpd, round trip. If oil production is established, traffic volume is expected to be about 3 vpd, round trip. This figure would be contingent on the amount of daily production established.

The heaviest traffic flow occurring in the Bridger-Teton National Forest and adjacent Grand Teton National Park occurs during the summer months and during hunting season. Since the major increase in traffic volume due to the proposed alternatives would occur during winter months when construction and rig up and down would take place, the impact on traffic volume would not be significant. The project traffic would not significantly increase or change the use pattern of U.S. Highway 287 or 89-191.

Service levels during construction and rig-up and rig-down would be impacted by the proposed alternatives, but not during the subsequent project phases. The increase in accident probability would not be greater than 5 percent and therefore would not be considered a significant impact.

The weight of the trucks required for use in all of the proposed alternatives would impact the existing road system. Road capabilities would be upgraded to safely manage these heavy loads. Details on specific areas and road modifications are contained in Chapter 2. Construction of new roads would occur on slopes exceeding 40 percent. Measures outlined in Chapter 2 would greatly reduce potential impacts associated with construction on slopes greater than 40 percent as discussed in the soils section of this chapter. The addition of 2 to 6 new miles of road would not significantly increase the road density on the Bridger-Teton National Forest.

The costs for required construction and reconstruction would be incurred by Amoco. If production is established and the road is used to transport product, a maintenance agreement would be entered into between the FS and Amoco. The use of roads would not create an additional financial burden upon the FS and the public.

4.3.3.2.1 Alternative A

To utilize this route, 18.6 miles of existing improved road would need to be upgraded, 1.5 miles of previously rehabilitated road would need to be reconstructed, and 1.8 miles of new road would be constructed in an unroaded area. The total amount of construction slopes exceeding 40 percent would be 3,930 feet (or 0.7 miles) of which 1,930 feet (0.4 miles) would be for new road construction. The maximum slope crossed on new roadway would be 60 percent on a 200-foot segment. New road construction along Kettle Creek would impact on existing pack trail which follows the road alignment. The potential pack trail impacts are discussed in more detail in the Recreation Section.

The estimated traffic volume for project-related traffic on Highway 287 would decrease the Service Level to "F" (refer to Table 3-1) for short periods of time during construction and rig up/rig down operations, but not for a significant period of time. Project traffic during drilling and production periods would not alter the Service Level of this road. The increased vehicle miles of travel would increase the vehicle accident probability by 0.5 percent, which would not be considered a significant impact.

The traffic generated on Flagstaff and Leidy Creek Roads by the proposed drilling operation would be similar to that of logging operations. The volume would increase somewhat during the construction and drilling phases. The operating Level of Service would not change. Because of proposed winter drilling operations, it would be necessary for the road to be upgraded to permit traffic flow in all-weather conditions. Winter plowing and drilling could generate vibrations sufficient to set off an avalanche. If the well is sufficiently productive to justify continued winter operations, plowing snow could become unwieldy because of the amount (70 to 90 or more inches) that would have to be moved.

4.3.3.2.2 Alternative B

Alternative B would utilize 14.2 miles of paved road which would require repair of 15.7 miles of existing improved road which must be upgraded, 7.2 miles of new road must be constructed in place of an existing unimproved road (from the Goose Wing Ranch to the end of the existing road along Cottonwood Creek), and 6.0 miles of new road must be constructed in an unroaded area within the Sohare Creek drainage. The maximum slope encountered on the new road would be 75 percent along a 0.6 mile section. An additional 0.6 miles of road would be constructed on slopes between 40 and 75 percent. The total amount of construction on slopes in excess of 40 percent would be or 2.2 miles. New road construction would occur along an existing pack trail. The potential pack trail impacts are discussed in more detail in the Recreation Section.

Project-related traffic could cause short-term drops to Service Level "F" on Highway 89-191 by creating forced traffic flow and low speed. The increased vehicle miles of travel would increase the vehicle accident probability by 0.25 percent, which would not be considered a significant impact.

Project traffic may decrease driver comfort on the segment of Gros Ventre Road to the town of Kelly to Service Level E (see Table 3-1) during construction and rig-up operations. There would be no change in service level during drilling operations, or if production was established. Increased vehicle miles of travel due to project traffic would not significantly increase the vehicle accident probability. Project traffic would change the use pattern of this road, requiring capital expenditures for upgrading the road to support heavy truck traffic. This expense would be incurred by Amoco.

Project traffic would change the use of existing FS roads. Major maintenance of existing roads would be required to support heavy truck traffic and to utilize these roads for all-weather conditions. As these roads presently have low traffic flow, the volume would increase, but not significantly, during construction and rig up/rig down operations. Traffic flow during drilling operations and if production is established would be minimal. The same impacts described in Alterative A associated with snow plowing would be applicable in this alternative.

4.3.3.2.3 Alternative C

Impacts on the existing road system resulting from Alternative C would be identical to those described for Alternative B. New road construction would follow the route described for Alternative B but would continue up Sohare Creek to the drill site. Total new construction would involve 4.4 miles of road. The maximum slope for this new road would be 80 percent on a 200 foot segment. New road construction would cross a total of 1.6 miles of slopes in excess of 40 percent. A portion of the new road would occur along an existing pack trail near Sohare Creek. Refer to the Recreation Section for more information on this potential impact.

4.3.3.2.4 Alternative D

Northern Staging Area (D1). Impacts to U.S. Highway 287 and Flagstaff and Leidy Creek Roads would be similar to those described for Alternative A. No new roads would be constructed under this alternative. Existing road (16.5 miles) would be used to access the staging area.

Southern Staging Area (D2). Impacts to U.S. Highway 89-191 and Gros Ventre Road would be similar to those described for Alternative B. No new roads would be constructed under this alterna-

tive. Existing road (30.8 miles) would be used to access the staging area.

4.3.4 Impacts Summary

Implementation of Alternatives A and D1 would result in the least impact on traffic using existing roads. These access routes utilize U.S. Highway 287, which is less congested with traffic than is U.S. Highway 89-191. The existing Flagstaff - Leidy Creek Roads would require less maintenance work than would the Gros Ventre route. Since traffic levels on the Gros Ventre Road are currently higher, repairs or maintenance would interrupt traffic to a greater extent than would the maintenance and minor upgrade along the Flagstaff route.

Alternatives B and C would require more new road construction (70 percent), a greater amount of construction on slopes exceeding 40 percent (65.7 percent), and the greatest cumulative miles of roadway than the other alternatives (49.2 percent). Alternative C would required 1.6 miles less of new road construction, and 0.6 miles less of new road across slopes in excess of 40 percent than Alternative B.

4.3.5 Cumulative Impacts

Impacts would be created by project traffic, but these would be short term and not considered significant.

Short-term impacts would occur by reducing the service level of U.S. Highway 89-191 and the Gros Ventre Road. Since this impact would be of short duration and occur during low traffic flow periods, the additional traffic to the area transportation system would be minimal.

4.3.6 Mitigation Summary

The measures proposed by the contractor (Chapter 2) for upgrading, reconstruction, and construction of new roads, on slopes greater than 40 percent and the completion of a Geotechnical Road Feasibility Evaluation and Report should preclude significant adverse environmental impacts to transportation. The following mitigation measures would also greatly reduce impacts:

- Concentrations of project traffic, such as truck convoys, or heavy or wide loads, should be scheduled to avoid periods of expected heavy traffic flows due to recreation.

- If well construction or drilling activities occur during deer/elk hunting season (August 15 through November 1) or elk migration, special signing to warn public of construction, speed limit signing, gate road from start of new construction should be implemented.

4.3.7 Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur to the transportation system.

4.4 SOILS

4.4.1 Introduction

Impacts resulting from drillpad and access road construction would include removal of vegetation and exposure and steepening of cut and fill slopes, resulting in the potential for increased runoff and erosion along with an increased probability for mass soil movement in some areas. Erosion potential would decrease within a short period of time with properly spaced drainage structures to disperse water from roads, direct discharge away from stream channels, and with prompt reestablishment of vegetation on disturbed areas. Observations of reclamation in the region indicate that with application of all available reclamation techniques, disturbed sites can be stabilized within 1-2 years of the application of the revegetation program. If not handled correctly, the removal of topsoil for revegetation purposes could reduce the natural fertility of the soil or cause coarse fragments from the subsoil to be mixed into the topsoil which would decrease its reclamation potential. The probable condition of disturbed sites in time is discussed in greater detail in the Vegetation, Timber, and Range Resources Section.

Access road construction would cross slopes in excess of 40 percent and other unstable existing landslides or other unstable areas, triggering landslides. Approval to construct a road in these areas would require an exception to Lease and/or Unit Agreement Stipulations. Consideration for such approval would be contingent upon the Lessee/Operator's completion of a Geotechnical Road Feasibility Evaluation and Report. The evaluation and report must demonstrate that road construction is feasible; the alignment required in order for it to be feasible; the construction methods and techniques which must be employed; any special measures necessary to avoid or prevent stream sedimentation and landslides; and requirements for successful reclamation.

The magnitude and frequency of landslide events is much less predictable and the potential for landslide occurrence persists over time. The potential extent of landslides would largely be determined by the height of cuts and fills and the resulting area of soil exposed. Since any road would be narrow and constructed to a minimum standard needed to access the site, cuts and fills would usually not be excessively high, except on very steep slopes. If landslides do occur, most would be small. Though small landslides are potentially disruptive to road use, significant environmental effects are not anticipated. The risk for larger landslides cannot be entirely ruled out, but such an event has a low probability.

Increased access along new roads into currently unroaded areas could cause an increase in off-road vehicle (ORV) use. Indirect impacts to soils could occur from rutting and compaction.

A summary of environmental consequences to soils is presented in Table 4-1, and a summary of soil reclamation potentials is presented in Table 4-2. Exhibit 3-2 shows the location of sensitive soils along the alternative access routes where the potential for significant impacts to soils would be high.

4.4.2 Impact Significance Criteria

Impacts resulting from construction and operation of the proposed project and alternatives are classified as being significant using criteria derived from government regulatory standards, previously prepared EISs, and professional judgement of resource specialists. The following criteria were used to determine significant impacts to soils:

- Impacts to soils were considered significant if increased erosion potential or reduction of soil productivity would prevent successful reclamation (the process of applying mechanical and revegetation techniques to limit soil loss to near preconstruction levels on disturbed sites) and eventual vegetation regeneration (reestablishment of at least 80 percent of pre-existing vegetative cover).

- Evaluations of successful reclamation were based on whether soils would stabilize to near pre-construction conditions within five years following application of appropriate reclamation measures.

- Construction of access roads across slopes in excess of 40 percent. Slope gradients of 40 percent tend to correspond to a threshold point at which cut and fill slopes become expansive resulting in a larger scar with greater erosion potential, lower soil productivity, and greater difficulty in successfully reclaiming the site; instability due to a greater mass of earth material being undercut resulting in increased landslide potential; and greater difficulty in returning the cut and fill slopes to the approximate original contour.

- Construction of access road or other facilities causing landslides or other mass movements of earth material to occur.

Table 4-1. Cumulative distances and areas of sensitive soils on which significant impacts could occur due to proposed project.[1]

	ALTERNATIVE									
	A		B		C		D1		D2	
	Short Term	Long[2] Term	Short Term	Long Term	Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
ACCESS ROADS										
Length: (miles)	3.3	3.3	13.2	13.2	11.6	11.6	N\A	N\A	N\A	N\A
Disturbed Area[3]: (acres)	20.0	10.0	80.0	40.0	70.0	35.0	-	-	-	-
Erosion Potential: (miles of road)										
LOW	0.3	3.0	7.5	11.0	7.5	10.0	-	-	-	-
MODERATE	2.7	0.3	3.5	2.2	2.5	1.6	-	-	-	-
HIGH	0.3	0.0	2.2	0.0	1.6	0.0	-	-	-	-
Landslide Probability: (miles of road)										
LOW	2.4	2.4	10.2	10.2	8.8	8.8	-	-	-	-
MODERATE	0.9	0.9	3.0	3.0	2.8	2.8	-	-	-	-
Road Construction across slopes in excess of 40 percent:	0.7		2.2		1.6		-		-	
HELICOPTER STAGING AREAS (acres)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Erosion Potential:										
LOW	-	-	-	-	-	-	4.0	0.0	4.0	0.0
Landslide Probability:										
LOW	-	-	-	-	-	-	4.0	0.0	4.0	0.0
DRILL SITES[2] (acres)										
Erosion Potential:										
LOW	5.5	6.0	5.5	6.0	5.5	6.0	5.5	6.0	0.0	0.0
MODERATE	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.0	0.0
Landslide Probability:										
LOW	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0.0	0.0
MODERATE	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0

1- See Exhibit 3-2 for map of sensitive areas

2- Cumulative area of disturbance would be reduced in the long term due to revegetation of cuts and hills, and potential reclamation of the well site during production phase.

3- Total area of disturbance assuming a 50-foot wide construction right-of-way for new road construction and roads requiring major reconstruction.

Table 4-2. Reclamation potential of soil disturbed due to project construction.

	Alternative				
	A	B	C	D1	D2
ACCESS ROADS: (miles)					
Attainable-Difficult	0.8	1.2	0.6	N/A	N/A
Attainable-Little or Moderate Difficulty	2.5	4.8	3.8	N/A	N/A
Total Length of Road to be Reclaimed	3.3	6.0	4.4	N/A	N/A
HELICOPTER STAGING AREAS: (acres)					
Attainable-Little or Moderate Difficulty	N/A	N/A	N/A	4.0	4.0
DRILL SITE: (acres)					
Attainable-Little or Moderate Difficulty	6.0	6.0	6.0	6.0	6.0

4.4.3 Direct and Indirect Impacts

4.4.3.1 Drill Site

In the short term, approximately 6 acres would be disturbed. Erosion potential associated with this disturbance would be low on the pad surface and moderate on cuts and fills. Landslide probability would be low except for the southeast corner of the site where the probability would be moderate. In the long term, erosion potential would be low. Landslide probability would be the same as in the short term.

The site could be reclaimed with low to moderate difficulty. Very gravelly soils on part of the site would limit the quantity of suitable topsoil, but sufficient soil would be available from other portions of the site for satisfactory reclamation.

4.4.3.2 Access Alternatives

4.4.3.2.1 Alternative A

Maintenance and upgrade of the existing road portion of the route would cause minor soil disturbance with no associated significant impacts.

In the short term, approximately 20 acres would be disturbed due to new road construction. Erosion potential would be moderate on most (80 percent) of the route, with short segments having both low and high erosion potential (10 and 10 percent, respectively). Approximately 0.7 miles of road construction would occur across slopes in excess of 40 percent. Landslide probability would be low on most (70 percent) of the route, with a moderate probability along approximately 30 percent of the route. In the long term, erosion potential would be low on most (90 percent) of the route, with a moderate erosion potential on cutslopes on a small part (10 percent) of the route. Landslide probability would remain the same throughout the duration of the project.

Reclamation could be attained with low to moderate difficulty along most (75 percent) of the route. Reclamation would be difficult but attainable on about one-quarter of the route.

4.4.3.2.2 Alternative B

In the short term, approximately 80 acres would be disturbed. Erosion potential would be low and moderate on most (55 and 25 percent, respectively) of the route, but a significant length (20 percent) would have a high erosion potential. Approximately 2.2 miles of road construction would occur across slopes in excess of 40 percent. Landslide probability would be low along most (75 percent) of the route, with a moderate probability on about one fourth of the route. In the long term, erosion potential would be low on most (80 percent) of the route, with a moderate potential on a smaller but significant length (20 percent) of cutslopes. Landslide probability would be the same as in the short term.

Reclamation could be attained with little or moderate difficulty on most (80 percent) of the route that would be reclaimed (above the mouth of Sohare Creek). Reclamation would be difficult but attainable on one fifth of the route to be reclaimed.

4.4.3.2.3 Alternative C

Approximately 70 acres would be disturbed in the short term. Erosion potential would be low and moderate on most (55 and 25 percent, respectively) of the route, but a high erosion potential would occur on a significant portion (20 percent) of the route. Approximately 1.6 miles of road construction would occur across slopes in excess of 40 percent. Landslide probability would be

low on most (75 percent) of the route, with a moderate probability on about one fourth of the route. In the long term, erosion potential would be low on most (85 percent) of the route, but moderate erosion potential would occur on a significant length (15 percent) of cutslopes. Landslide probability would be the same as discussed for the short term.

Reclamation could be attained with low to moderate difficulty on most (85 percent) of the route to be reclaimed (above the mouth of Sohare Creek). Reclamation would be difficult but attainable on a minor (15 percent) portion of the route to be reclaimed.

4.4.3.2.4 Alternative D

Implementation of either of the helicopter staging areas would result in disturbance of approximately 4 acres in the short term. No landslide or slope instability potential is associated with each site. Reclamation could be attained with little or moderate difficulty at both sites. Topsoil quantity is limited by a thin topsoil layer over very gravelly subsoils, but the quantity would be adequate for satisfactory reclamation.

4.4.4 Impacts Summary

No significant impact to soils at the drill site is anticipated as a result of constructing and operating the proposed project. Each of the road access alternatives would involve road construction across slopes in excess of 40 percent, which would be considered significant for reasons discussed in the impact significance criteria. However, with special construction techniques described in Chapter 2 (Section 2.2.2), the potential significant impacts that would occur could be greatly reduced or avoided. In addition, further mitigation in terms of specially designed and intensive application of runoff and erosion control on the reclaimed steep slopes would greatly reduce the magnitude of probable impacts to soils at these sites.

All road alternatives have segments which would be difficult but feasible to reclaim. A difficult reclamation rating is primarily due to steep slopes which would require special planning and effort along with aggressive revegetation efforts to restore near present contours and productivity. Successful reclamation is considered to be attainable as demonstrated by other reclaimed roads in the region with similar elevation, soils, parent material, and habitat types.

Table 4-1 indicates that there is a considerable difference among the alternatives regarding potential impacts. For example, the greater the length of road exposed to moderate probability for landslides, the greater the probability that landslides would actually occur. Though it is anticipated that most potential landslides would be small, an increased length and time of

exposure also increases the possibility for larger slides. Based on the summary provided in Table 4-1, road access Alternative A would have the lowest potential for significant impacts to soils followed by Alternative C, and then B.

Assuming an exploration phase only, the helicopter access alternative (Alternative D) would have the least potential for significant impacts of all the action alternatives. There would be no difference between the staging area implemented relative to significant impacts to soils.

4.4.5 Cumulative Impacts

No significant cumulative impacts are expected as a result of the project implementation. The implementation of any of the Alternatives is not expected to significantly add to impacts that have occurred due to similar development projects in the area as itemized in Chapter 4.0.

4.4.6 Mitigation Summary

A site-specific and prudently applied reclamation plan would greatly reduce adverse impacts to soils including erosion losses. Interceptor ditches encompassing the wellpad and campsite draining/flowing into/through sediment traps would control erosion and prevent sediment from reaching streams. All topsoil should be stripped from areas to be disturbed, stored off-site, and reapplied to ensure a productive growth media for plants. Successful and timely revegetation of disturbed areas would greatly reduce impacts to soils. Special road construction using best available engineering design (i.e., alignment techniques for precluding erosion, landslide, or sediment from reaching streams, etc.), best construction techniques (i.e., benching, partial benching with fill, barriers or retaining walls, end hauling, etc.) and monitoring plans (i.e., quality control, etc.) could reduce the inherent hazards of crossing slopes in excess of 40 percent, slopes with moderate or greater instability potential, or existing landslides. A Geotechnical Road Feasibility Evaluation and Report will be completed by a qualified professional who is also experienced in mountain terrain road construction. The geotechnical analysis will provide location information where these measures would be implemented.

4.4.7 Unavoidable Adverse Impacts

Short-term impacts of cut-slope instability and the potential for repeated attempts to reclaim them would occur. Short-term increase in sediments reaching streams would occur. Road cuts across wet soils or landslide-susceptible areas could cause future problems.

4.5 WATER RESOURCES

4.5.1 Introduction

Impacts associated with drill pad and access road construction include the removal of vegetation, exposure of the soil surface, and compaction of the soil which greatly increases overland flow and subsequent erosion and off-site sedimentation. These changes would occur along segments of new access road in close proximity to a stream channel, creating the potential for increased stream flow, increased stream sedimentation, and subsequent degradation of water quality.

Approval to construct an access road within 500 feet of a stream or spring would require an exception to lease and/or unit agreement stipulations. Approval would be contingent upon demonstration that road construction is feasible and that it can be done without significant increase in stream sedimentation or water quality degradation. This demonstration would be a required element of the Geotechnical Road Feasibility Evaluation and Report described in the Soils Section (4.4.1).

The magnitude and duration of these impacts depend on several factors, including slope aspect and gradient, degree and area of soil disturbance, susceptibility of soil to erosion, proximity to established drainage channels. The duration of time within which construction activities take place, and the timely implementation of and success or failure of mitigation measures applied would also be factors. These impacts would be greatest soon after the commencement of construction activities but would naturally decrease shortly after due to passive natural stabilization.

Slope destabilization and drainage problems could occur in areas where construction traverses unstable slopes due to surface seepage or a high water table. Slumps could occur as a result and, depending on the proximity to a stream channel, could cause substantial stream sedimentation.

Construction of stream crossings could also cause increased stream sedimentation, and channel bed disruption resulting in destabilization of the channel which in turn could cause major shifts and readjustments of streamflow hydraulics.

The leakage or spillage of reserve pit fluids could degrade surface and groundwater. The potential of such an impact occurring would depend on the quantity released and the proximity to the water body potentially impacted. Spillage of petrochemicals associated with construction or operation of the project could also impact both surface and groundwater if released in close proximity to these water bodies. Groundwater contamination could occur from well construction or operation due to the leakage of drilling fluids into groundwater, or due to the mixing

of groundwater of differing quality from different aquifers. Groundwater, oil, and gas may occur under high pressure which, upon being penetrated during well drilling, could migrate laterally along geologic strata or vertically along the outside of the well casing to areas of lower pressure. Contamination could reach surface water in areas at or below seeps, springs, or significant groundwater outflow.

4.5.2 Impact Significance Criteria

Impacts to water resources that would occur due to project construction, operation, and abandonment are classified as significant using criteria derived from government regulatory standards, available scientific documentation, previously prepared EISs and the professional judgment of resource specialists. The following criteria were used to determine significant impacts to surface water resources as a result of project implementation.

Significant impacts to surface water would potentially occur if:

- Degradation of water quality occurred to the point that it did not meet state standards as itemized by the Rules and Regulations of the Water Quality Division of the Wyoming Department of Environmental Quality.
- Modification of quantity or quality of stream flows occurred to the extent that established users are adversely affected.
- The instream flow of water is reduced by 5 percent for more than 24 hours, adversely affecting fisheries or downstream water users.
- Alteration of channel geometry, flow gradients, or flow regime occurred causing undesirable effects such as aggradation, degradation, or side cutting.
- The location of above-ground facilities were within 500 feet of the normal high waterline of any and all streams, lakes, ponds, and reservoir, or 400 feet of any spring located within the lease area.
- Downstream sedimentation affects the operation of irrigation and domestic water control structures.

Significant impacts to groundwater would potentially occur if:

- Degradation of the quality of groundwater contained in fresh water aquifers occurred to the point that it did not meet state standards as itemized by the Rules and Regulations of the Water Quality Division of the Wyoming Department of Environmental Quality.

- An increase or decrease in water table levels were to occur caused by construction or operation of the proposed project.

4.5.3 Direct and Indirect Impacts

4.5.3.1 Drill Site

Approximately 6 acres would be disturbed and/or denuded during the construction and operation of the drill site and man camp. Due to the relatively gentle slopes characteristic of the site, little opportunity for significant erosion and subsequent off-site sedimentation would occur. A slight increase in surface runoff from the drill pad may occur, however, this increase would be short term, of low magnitude, and not significant. Interception ditches and sediment traps (see Exhibit 2-2) would be implemented to control and treat (filter) all surface runoff from the pad area. No perennial or intermittent channels occur in the immediate vicinity of the drill site. The swale in the bottom of the valley is heavily vegetated with forbs and grasses; and therefore, no channel sedimentation would be expected since the vegetation would trap, retain, and stabilize the vast majority of any sediment reaching the swale. Therefore, the potential for significantly affecting surface water quality and quantity is very low.

Due to the valley bottom position, there is a possibility that a shallow water table might be intersected at the locations of the maximum cuts during and shortly after the snowmelt season. Although the occurrence and distribution of aquifers at depths greater than 30 feet are unknown, there is a potential that groundwater contamination could occur should an aquifer be encountered during the drilling process. However, the likelihood of such an occurrence is remote since the applicant would weld the well casing joints and cement the annular space between the outside of the well casing and the surrounding borehole. Therefore, it is unlikely that groundwater quality would be significantly impacted.

A reserve pit failure and subsequent discharge of its contents could cause a significant short-term impact to water quality if its contents reached Sohare Creek or groundwater. However, the potential for such an occurrence is very remote. Leakage of reserve pit materials could reach and contaminate surface and groundwater. However, the applicant has proposed to line the reserve pit with either a synthetic or clay liner, or both, which would essentially eliminate the potential of a leak occurring. Reserve pit overflow could potentially occur during or following drilling. Heavy rains or snowmelt could fill and overflow the pit. However over-design of the reserve pit, or utilizing a maximum of 75 percent of its capacity for drilling wastes, and the balance for direct precipitation and runoff would preclude

any overflow. Therefore, no significant impacts to the water resources of the area would occur as a result of the construction and operation of the drill site.

4.5.3.2 Access Alternatives

4.5.3.2.1 Alternative A

A minor amount of road realignment and blading may be required along the existing portion of the Flagstaff Road from U.S. Highway 26-287 to the confluence of Kettle Creek and the South Fork of Spread Creek, which could cause a minor short-term increase in erosion and subsequent sedimentation of Spread Creek. However, a vegetation buffer between the road and stream would preclude this potential impact. Six existing crossings by bridge of perennial streams is made by this portion of the access road. No construction at these crossings is anticipated.

Reconstruction and construction of the route from the confluence of Spread Creek and Kettle Creek to the divide between Kettle Creek and Sohare Creek would occur within 500 feet of Kettle Creek for approximately 2.2 miles involving two crossings of Kettle Creek. This activity would result in a potentially significant increase in erosion and sedimentation of the creek and subsequent degradation of water quality. However, according to Stuart (1986) the Exxon drill site access road which this route would follow was constructed without any apparent significant impact to Kettle Creek. Road construction across several perennial seeps may result in increased potential of minor road and slope instability. However, with special construction across these seeps as itemized in Chapter 2 (Section 2.2.2), the resulting impacts would be minor and not significant.

The proposed road from the divide to the drill site would include construction on steep slopes of up to 70 percent and crossing of several high energy ephemeral channels or debris flows channels. The high energy ephemeral channels that would be crossed could be a location of greatly increased erosion, and off-site sedimentation. The eroded materials would remain in close proximity to the toe of the fill slope. Prudent design and mitigation including the placement of culverts with sufficient capacity to carry the high energy flows would minimize increased erosion and sedimentation on these steep slopes.

If the well were to go into production, the probability, though very low, of an oil spill from tank truck accident contaminating and therefore significantly impacting water quality of surface water would increase.

4.5.3.2.2 Alternative B

Impacts that would occur as a result of implementing this alternative would be similar to those described for Alternative A. No significant impact to water quality and quantity is expected to result from using the portion of existing improved road from the Gros Ventre Road to near the Cottonwood Creek drainage. Some minor realignment and blading may be required, causing some short-term increase in erosion and off-site sedimentation.

Approximately 5.1 miles of new road construction and major existing road upgrade would be required within 500 feet of Cottonwood Creek from the point the route enters the Cottonwood Creek drainage to the confluence with Sohare Creek. An additional 1.0 mile of major road reconstruction would occur on the Cottonwood Creek floodplain but not within 500 feet of the stream. In addition, several steep slopes with high erosion and slope instability potential would be traversed at a point where the creek encroaches on existing road fill. Road reconstruction at this point would cause increased sediment loading of the creek which would be considered significant. This segment of the road would require approximately six stream crossings including two crossings of Cottonwood Creek, and four other crossings including Little Sohare Creek and Sohare Creek. The road construction activity along this segment of the access route has the potential of greatly increasing sediment loading of Cottonwood Creek in the short term. However, once the disturbed areas become stabilized, sediment loading in the long term should decrease from the present since bridges would be constructed to replace the current stream fords, thus removing the disruption caused by vehicles traversing the creek.

From the confluence of Sohare Creek and Cottonwood Creek to the point where the road would leave Sohare Creek, construction of approximately 1.7 miles of new road within 500 feet of Sohare Creek would result in increased sediment loading of the creek because much of the route is on or adjacent to the floodplain, or on steep side slopes above the creek. The potential for significantly impacting the creek through decreased water quality or altered flow regimes would be high.

Road construction from Sohare Creek to the drill site would result in crossing three streams including Sohare Creek and two small tributary streams. Approximately 0.2 miles of new road construction would occur within 500 feet of these streams. Bridges would be constructed at these crossings. The potential for significantly increasing sedimentation of these streams as a result of new road construction is high. Several perennial seeps would be crossed along this road segment on steep slopes where the potential for mass failure due to construction activities could be high. At several points, a mass failure could supply

tributaries to Sohare Creek with sediment. However, special road construction design has been proposed for crossing seep areas as described in Chapter 2 (Section 2.2.2), which would greatly reduce the potential of mass failures.

4.5.3.2.3 Alternative C

Impacts similar to those described above for Alternative B would occur if this alternative was implemented. In addition to impacts discussed under Alternative B up to the last crossing of Sohare Creek, this alternative would involve construction of approximately 0.9 miles of road within 500 feet of Sohare Creek. The potential for significant sedimentation of Sohare Creek would be high. No stream crossings would be included in this portion of the route.

4.5.3.2.4 Alternative D

Northern Staging Area (D1). Implementation of the northern helicopter staging area would result in the same impacts described for the existing road portion of Alternative A from U.S. Highway 26-287 along the Flagstaff Road to Kettle Creek. No significant impact is expected to occur as a result of improving this section of road. A 4-acre staging area would be constructed. No significant impacts beyond a minor short-term increase in soil erosion and runoff into adjacent vegetation would occur due to implementation of this alternative.

Southern Staging Area (D2). Implementation of the southern helicopter staging area would result in the same impacts described for the existing road portion of Alternative B where minor road improvement may be required from the Gros Ventre Road to the staging area. A 4-acre staging area would be constructed. No significant impacts beyond a minor short-term increase in soil erosion and runoff would occur due to implementation of this alternative.

4.5.4 Impacts Summary

4.5.4.1 Drill Site

No significant impact, as determined by the significance criteria previously presented, to the water resources in the vicinity of the drill site is expected since surface runoff and erosion control structures would be used to minimize impacts to levels not considered significant. Other measures as proposed by the applicant would be employed to minimize the potential of contaminating groundwater during well drilling and as a result of leakage or overflow of reserve pit fluids.

4.5.4.2 Access Alternatives

Significant impacts, as determined by significance criteria, would include primarily a reduction in water quality and altered flow regimes due to increased sediment transport due to erosion from disturbed areas within the stream environment (i.e., within 500 feet of live streams). Of particular concern are impacts associated with the construction of stream crossings where alteration of the channel bed geometry could cause major channel rearrangement, alteration of flow regime, flooding, and increased sedimentation. Although these impacts would affect fish, wildlife, and wetlands, the potential for significantly impacting downstream water users would be low due to the distal location of water withdrawal from the project area. Consequently, the best indicators of moderate to high potential for significantly impacting water resources include the cumulative distance or area of construction within the stream environment (i.e., within 500 feet of live streams) and the number of stream crossings. Table 4-3 summarizes the characteristics of each alternative which could lead to significant impacts.

Of the three roading alternatives, as indicated in Table 4-3, Alternative A would have the lowest potential for significant impacts to water resources, since less road construction within 500 feet of live streams and fewer stream crossings would be required. Alternatives B and C would have the highest potential for impact to water resources. However, Alternative B would have slightly less potential for impact than Alternative C.

Alternative D, helicopter access, using either of the staging areas, would result in the least impact when compared to roading access. Substantial areas of new road construction and major reconstruction within 500 feet of live streams and stream crossings would be avoided with helicopter access.

4.5.5 Cumulative Impacts

Implementation of the proposed drill site or access alternatives under consideration would not be expected to cause significant cumulative impacts to surface or groundwater resources, or add significantly to impacts that have occurred or that may occur due to implementation of similar projects in the area as listed in Section 4.0.

4.5.6 Mitigation Summary

Mitigation measures that would reduce impacts to levels not considered significant or that avoid significant impacts are itemized in detail in the Mitigation Section. These measures include implementation of a detailed site-specific runoff and erosion control, and reclamation plan. Site-specific construction plans designed to minimize impacts to sensitive areas such as

Table 4-3 Comparison of characteristics of each alternative that could lead to significant impacts to water resources as a result of project implementation.

	Alternative				
	A	B	C	D1	D2
Road construction within 500 feet of live streams:					
Cumulative Distance (mi)	2.2	5.1	5.7	0	0
Cumulative area* (ac)	13.3	30.9	34.5	0	0
Stream Crossings:					
Existing crossings not requiring major reconstruction	6	3	3	5	3
New crossings or crossings requiring major reconstruction	2	9	8	0	0
Total stream crossings	8	12	11	5	3

* - area of disturbance assuming an average construction zone width of 50 feet.

stream crossings or areas within 500 feet of the stream environment, or areas on slopes with steep gradients or a shallow water table would reduce most impacts to levels not considered significant. Wherever road construction alters stream beds, the stream bed should be retained to the original geometric configuration with original substrate, or armoring the channel bed would reduce downstream sedimentation. Interceptor ditches encompassing the wellpad, campsite, or helicopter staging area draining/flowing into/through sediment traps would control erosion and prevent sediment from reaching streams. The area disturbed due to road construction within the stream environment should be minimized. State-of-the-art casing and cementing technology would minimize contamination of groundwater during well drilling and well operation. This technology includes casing the well during drilling and cementing the annulus between the casing and wellbore. Special design and construction of reserve pits such as placement in cut rather than fill and the use of mud and/or synthetic liners would minimize the opportunity for contamination of surface water and groundwater resources. The pit should be

designed such that only 75 percent of total capacity is utilized, leaving the balance of 25 percent to hold direct precipitation and runoff. Monitoring of surface water quality should be conducted throughout construction and until reclamation is completed to detect significant changes.

4.5.7 Unavoidable Adverse Impacts

4.5.7.1 Drill Site

The proposed runoff and erosion control measures combined with the recommended mitigation would reduce impacts to levels not considered significant. Therefore, no unavoidable adverse impacts are expected to occur as a result of constructing and operating the proposed drill site.

4.5.7.2 Access Alternatives

Significant impacts to water resources in the project area would occur regardless of whether Alternative A, B, or C were implemented. However, with successful implementation of the proposed construction measures and mitigation measures, impacts are expected to be reduced to levels not considered significant. Therefore, no unavoidable adverse impacts to surface and groundwater quality are expected as a result of constructing and operating any of the road access alternatives. However, some increased sedimentation in the short term would be inevitable, although at levels not considered significant. No unavoidable adverse impacts are expected as a result of implementing the Alternative D staging areas. The costs of mitigating significant impacts would be greatest for Alternatives B and C, less for Alternative A, and the least for Alternative D.

4.6 FISHERIES

4.6.1 Introduction

The impacts that could occur to fishery resources of the affected environment would primarily result directly from the sedimentation and stream channel disruption and rearrangement effects described in the Water Resources Section of this chapter. Sedimentation and turbidity can directly affect fish populations in several ways. Reduced visibility can impair feeding efficiency of most trout species. Sedimentation of spawning areas can reduce or eliminate trout reproduction in those areas. Studies have shown that trout eggs suffer a mortality rate of approximately 85 percent when 15 to 20 percent of the interstitial spaces in spawning gravels are filled with sediments (Bell 1986). High turbidities or prolonged exposure to elevated turbidities can also affect adult and juvenile fish by physically interfering with respiration. Evidence of gill irritation in

trout fingerlings held in turbid water has been noted frequently and is considered a common avenue of infection for fungi and pathogenic bacteria.

Fish populations can also be indirectly affected by sedimentation. Increased suspended sediments can decrease primary and benthic invertebrate populations by reducing light penetration and siltation of benthic invertebrate habitats, thus decreasing overall production of fish food organisms within the stream.

Other potential impacts to fisheries would include the impacts resulting from removal of streamside cover during construction of stream crossings, increased fishing pressure, and catastrophic accidents such as fuel spills or leakage of waste material into the stream.

4.6.2 Impact Significance Criteria

The following criteria were used to determine whether impacts caused by the construction and operation of the project would be significant:

- If fish habitat were altered or sedimentation increased such that a population reduction occurs in the long term as a result of stream bed disturbance, rechannelization, or road and bridge construction.
- If streams were dewatered to the point that mortality of fish occurred due to reduction in available habitat and/or food.
- If streams were contaminated by spills of drilling wastes, petroleum products, or other by-products of construction.
- If increased fishing pressure were to result from increased ease of access.

4.6.3 Direct and Indirect Impacts

4.6.3.1 Drill Site

No direct or indirect impacts would occur as a result of construction of the proposed drill site due to its distal location to stream channels. Increased fishing pressure of Sohare Creek could occur as a result of close access from the drill site. However, with appropriate restrictions including closing vehicular access to the drill site by unauthorized people, the impact could be avoided.

4.6.3.2 Access Alternatives

4.6.3.2.1 Alternative A

The first 18.6 miles and of this route is existing road along the South Fork of Spread Creek and Kettle Creek and would involve relatively little impact on fishery resources. The reconstruction of previously reclaimed road up Kettle Creek would involve a higher level of potential impact through disruption of stream habitat in Kettle Creek due to increased sedimentation. However, the Wyoming Game and Fish Department indicates that the previous road was completed without major stream disruption or increased sedimentation (Huddelson 1986) because of the measures implemented to prevent fill, runoff and erosion sedement from entering the stream. Similar impacts would occur with new road construction along upper Kettle Creek. Impacts could be significant in this section if proper sediment control were not implemented. This includes the employment of such measures as wing ditches into vegetation or straw bales to filter out sediment; sediment traps and filters before or after road and roadside drainage passes through culverts.

4.6.3.2.2 Alternative B

The minor improvement of the Gros Ventre Road is not expected to significantly impact fishery resources of the Gros Ventre River. Major reconstruction of the Cottonwood Creek Road would unavoidably impact Cottonwood Creek in the short term as a result of increased sedimentation of this stream. Bridges would be constructed at the three crossings of Cottonwood Creek, which would greatly decrease the potential for significantly impacting flow regime, sedimentation, fish migration, and fish habitat at these sites as compared to culverts. New road construction in the lower section of Sohare Creek could impact fish habitat where the road would be in close proximity to the stream. Wyoming Game and Fish Department has concern over any disruption which might cause additional sediment transport in the Cottonwood Creek (Huddelson 1986). The potential for significant impact to the fishery resources of Cottonwood Creek and Sohare Creek would be high unless proper sediment control procedures were implemented.

4.6.3.2.3 Alternative C

Impacts that would occur as a result of implementing this alternative would be very similar to those described under Alternative B. However, additional road construction and operation along Sohare Creek could result in increased sedimentation.

4.6.3.2.4 Alternative D

No impact to the fishery resources associated with either of the staging areas, identified as D1 and D2, or access to the sites would occur.

4.6.4 Impacts Summary

The potential for significant impacts, as determined by the significance criteria, to the fishery resource of the South Fork of Spread Creek, Kettle Creek, Cottonwood Creek, and Sohare Creek would be considered high. Based on the total mileage of road construction within the stream environment, Alternative A would have the least potential for significantly impacting fishery resources, followed by Alternative B, and then C. Alternative D would have very little if any impacts associated with it. Assuming an exploration scenario, implementation of Alternative D would cause the least impact to fishery resources. However, should the well go into production, one of the access road alternatives would likely be implemented to facilitate transport of the product off-site.

4.6.5 Cumulative Impacts

Construction associated with the well site or access road for any of the alternatives would not result in significant cumulative impacts to fishery resources of the project area. Impacts caused as a result of project implementation would not significantly add to impacts that have or would likely occur as a result of recent or foreseeable future projects as itemized in Section 4.0.

4.6.6 Mitigation Summary

Mitigation measures that would alleviate significant impacts to fisheries would be the same as those described under the Mitigation Summary section of the Water Resources section of this chapter. These measures include implementing site-specific runoff and erosion control and a stream reclamation plans and employment of available industrial technology to minimize contamination of streams. Sediment should be controlled by designing runoff control with sediment filtering and/or settling provisions. Bridges should be installed at all perennial stream crossings. The access road should be closed to unauthorized vehicle traffic. Monitoring of fisheries population and habitat should be required in waters affected by construction until successful reclamation and disturbed site stabilization has occurred. Continued monitoring for point source pollution should continue for the life of the project. The Lessee/Operator should submit for approval a plan to carry out fisheries monitoring before surface disturbing activity is allowed.

4.6.7 Unavoidable Adverse Impacts

Full and successful implementation of the mitigation measures described above and under the Mitigation Summary section of the Water Resources section would avoid or reduce all impacts to trout fisheries to levels not considered to be significant. It is possible that a low level of increased sedimentation would occur during the construction phase of the project, but it is unlikely that this low level increase in sediment loading would result in fish mortality.

4.7 VEGETATION, TIMBER, AND RANGE RESOURCES

4.7.1 Introduction

Direct impacts to vegetation primarily involve the clearing and disturbance of vegetation due to road, drill pad, or other project component construction. The duration of resultant impacts depends on the time required for natural succession to return the revegetated areas to a pre-disturbance condition of cover and stability. If the well went into production the initial restoration of the site would be delayed for the life of the project. Generally, all the vegetation community types occurring within the affected area have a fair or good revegetation potential. In other words, the soils and climatic factors as well as technology are such that all disturbed areas could be stabilized within 1 to 2 years with vegetation growth, runoff, and erosion control methods. The newly established vegetation and stabilized site would promote natural succession which would ultimately result in the disturbed areas being returned to pre-disturbance conditions. The time required to reach pre-disturbance conditions is speculative at best, but would be on the order of 20 years for non-forested types, and from 100 years to over 200 years for the forested types.

Assuming successful implementation of reclamation and revegetation (including topsoil stripping, storage, and replacement; seedbed preparation; planting of a seedmix designed specifically for the site; fertilization; and weed control), the following conditions can be expected to occur on the average at the non-forested revegetated sites in time (Bowers 1987):

- First year - grasses dominate the ground with approximately a 70 percent cover. Forbs and some shrubs are also present. Forbs may make up at most 50 percent of the vegetal cover.

- Second year - grasses maintain their dominance, but forbs increase in cover density. Shrubs become noticeable, but do not contribute a significant portion of the total vegetal cover. Total vegetal cover may increase slightly over the first year.

- Fifth year - forbs and shrubs become the dominant vegetal cover. Native grasses, forbs, and shrubs become more prevalent in the vegetal cover. Total vegetal cover typically approaches 80 percent.

- Tenth year - vegetal cover is dominated by forbs and shrubs with lesser amounts of grasses. Plants that have moved in naturally dominate the vegetation. It is difficult to distinguish between the revegetated site and the undisturbed surrounding vegetation.

- Twentieth year - it is almost impossible to distinguish the revegetated site from the surrounding undisturbed vegetation. Species composition and vegetation structure are almost identical to the surroundings.

Forested sites would not revegetate to pre-disturbance conditions as quickly as non-forested sites. Assuming that natural seed dispersal would be the only mechanism for conifers to become established, revegetation of a forested site would progress in a manner similar to non-forested sites. In time conifers would become established and by 100 years the previously forested areas would be covered by pole to small sawlog-sized timber. By 200 to 300 years, the revegetated sites would resemble the pre-disturbance condition within old growth stands.

Construction activities could introduce undesirable and noxious weed species into an otherwise weed-free area. These weeds often out-compete the more desirable species rendering the site less productive as a source of forage for livestock and wildlife. Sites dominated by weeds also take on a different visual character which often is in visual contrast to surrounding undisturbed vegetation.

The construction of new road through or adjacent to forest stands with commercially valuable timber could be considered an indirect beneficial impact since these stands could be accessed for timber harvest. The quality and quantity of timber resources that would be accessed are summarized on a stand basis in Appendix B of the Vegetation, Timber, and Range Resources Technical Report. The feasibility and economic impacts of such harvest are beyond the scope of this analysis. Refer to the Gunsight Pass Management Area Timber Sale Environmental Assessment prepared by the Forest Service (USDA 1985) for an indication of economic impacts that could occur should timber be harvested. No construction would occur in stands or compartments where timber stand improvements have been made. Thus, no loss of capital investments for improvements would occur.

No impacts to sensitive plant species including federally listed threatened or endangered or candidate species, and other rare

plant species is anticipated since no sensitive species are known to occur in the project area.

Impacts to grazing can take several forms. The most obvious is the direct loss of forage through construction or operation of the proposed action. If the loss of forage is severe enough it can reduce the carrying capacity of the allotment for livestock necessitating a reduction or reassignment of livestock. Such a loss has a direct economic effect on the permittee and FS. Other types of losses associated with oil field development are those involved with increased road access throughout the allotment and the construction activities. Development and construction activities often require cutting fences or making cattle guards temporarily ineffective for maintaining livestock separation and control. Also, new roads or even improved roads encourage cattle to move along the roadway and eventually out of an area. Without adequate separation and control of livestock, the permittee can lose livestock, have cattle breed at inappropriate times or by non-preferred bulls, and be required to expend larger amounts of time and money gathering livestock. Depending on the amount and duration of the loss of livestock control, losses can be significant, particularly to the permittee. Direct losses through theft, vehicle collisions, or other means are also potentially increased with more activity within the allotment units.

4.7.2 Impact Significance Criteria

Impacts to vegetation, timber, and range resources associated with implementation of the proposed action or alternatives were classified as significant using criteria developed from governmental regulatory standards, available scientific documentation, reclamation technology and objectives, and the professional judgement of resource specialists. The impacts were considered significant if:

- Reclamation of disturbed areas would not have an adequate cover of vegetation to stabilize the disturbed site to pre-disturbance conditions, or species composition to support pre-existing land use including grazing, wildlife habitat, and recreation within five years following revegetation.

- Removal or disturbance of riparian and wetland vegetation occurred during road, drill site, or other project component construction. Wetlands are of particular concern since they are relatively rare in the project area, provide unique and important wildlife and fishery habitat, and are integral components of riverine systems by nature of their ability to route flood waters and treat water to maintain high quality. Wetlands are protected under the Federal Clean Water Act.

- Any federally listed threatened or endangered, or candidate plant species, or other rare species were affected through direct mortality of individual plants or reduction of required habitat. These impacts could contribute to the decline of any sensitive plant species that may occur in the project area.

- The number of AUMs on any grazing allotment was reduced by 5 percent or more through the clearing and/or disturbance of vegetation.

- There was a disruption of critical ranching operations such as calving, livestock trailing, maintenance of control or separation of livestock, maintenance of stock watering sources, and the ability to use the range in a normal manner.

4.7.3 Direct and Indirect Impacts

4.7.3.1 Drill Site

Construction and operation of the proposed drill site and worker camp would cause the clearing and disturbance of approximately 4 acres of upland meadow and 2 acres of spruce-fir (including some whitebark pine) vegetation types in the short term. Should the well prove to be "dry", the site would be reclaimed and revegetated with the objective to meet pre-disturbance conditions in the long term. Since there is a fair to good potential for successful revegetation, the impacts associated with the loss of vegetation would be short term and not considered significant. Should the well prove to be a "producer", the pad area would be reduced in size and revegetated. The impacts associated with vegetation clearing and disturbance in the portion of the well that would be retained for production would be long term, however, not significant. Trees of merchantable size cut down in the clearing process would be directly purchased by Amoco at current market price.

Direct loss of forage would result from construction and operation of the proposed drill site within the Red Creek Unit of the Fish Creek C&H Allotment. However, the percent AUMs lost due to vegetation clearing within the allotment would not exceed 1.0 percent. Therefore, no significant impact to range resources is anticipated.

4.7.3.2 Access Alternatives

4.7.3.2.1 Alternative A

Construction of the new road to the drill site would clear and disturb approximately 20 acres of vegetation including 1.2 acres of spruce-fir, 3.6 acres of mixed pine, 12.7 acres of upland

meadow, and 2.5 acres of wet subirrigated meadow and riparian willow. The majority of the mixed pine that would be impacted is dominated by whitebark pine, an important habitat and source of forage for the grizzly bear. The loss of 2.5 acres of wetland (wet subirrigated meadow and riparian willow) would be considered significant although successful revegetation of the wetlands would mitigate the impact if the road was to be reclaimed in the short term (i.e., an unproductive well). Should the well go into production, the loss of wetland vegetation associated with road construction would be a long-term significant impact.

The loss of 4.8 acres of timber would be mitigated by Amoco's purchase at current market price.

Construction and operation of Alternative A would result in direct loss of forage on approximately 6.0 acres within the South Fork of Spread Creek Unit and 14 acres within the Red Creek Unit of the Fish Creek Allotment. This loss of forage would represent less than 1.0 percent of the total AUMs on the allotment and therefore is not considered significant.

4.7.3.2.2 Alternative B

Construction of this access alternative would clear and disturb approximately 80 acres of vegetation. Approximately 8.5 acres of subirrigated wet meadow and willow riparian vegetation would be cleared due reconstruction of the Cottonwood Creek Road, new construction along Sohare Creek, and at several small stream and perennial seep crossings. In addition to the wetland loss, approximately 20.5 acres of spruce-fir, 9.1 acres of mixed pine (including some whitebark pine trees), 5.0 acres of upland meadow, and 36.4 acres of sagebrush would be cleared under this alternative. The significance of these impacts were previously discussed under Alternative A.

Construction and operation of Alternative B would result in direct loss of forage on approximately 43 acres of the Breakneck Unit and 37 acres on the Red Creek Unit of the Fish Creek C&H Allotment. This loss of forage would represent less than 1.0 percent of the total AUMs on the allotment and therefore is not considered significant.

4.7.3.2.3 Alternative C

Construction of this access alternative would clear and disturb a total of approximately 70.3 acres of vegetation. Approximately 36.4 acres of sagebrush, 7.8 acres of upland meadow, 12.1 acres of spruce-fir, 5.5 acres of mixed pine (including some whitebark pine), and 8.5 acres of wetland would be cleared. The significance of these impacts were previously discussed under Alternative A.

Construction and operation of Alternative C would result in direct loss of forage on approximately 43 acres of the Breakneck Unit and 27 acres of the Red Creek Unit of the Fish Creek C&H Allotment. This loss of forage would represent less than 1.0 percent of the total AUMs on the allotment and therefore is not considered significant.

4.7.3.2.4 Alternative D

Northern Staging Area (D1). Minimal impact would occur to the vegetation, timber, and range resources as a result of accessing the Spread Creek D1 staging area since existing roads with minimal upgrade would be utilized. Construction of the staging area would require clearing of approximately 4 acres of sagebrush vegetation which would not be considered significant. This activity would take place within the South Fork of Spread Creek Unit of the Fish Creek C&H Allotment. This loss of forage would represent less than 1.0 percent of the total AUMs on the allotment and therefore is not considered significant.

Southern Staging Area (D2). Likewise, minimal impact would occur to vegetation and timber resources as a result of accessing the Dry Cottonwood Creek D2 staging area since existing roads with minimal upgrade would be utilized. Construction of the staging area would require the clearing of approximately 4 acres of sagebrush vegetation which would not be considered significant. This activity would take place within the Breakneck Unit of the Fish Creek Allotment. This loss of forage would represent less than 1.0 percent of the total AUMs on the allotment and therefore is not considered significant.

4.7.4 Impacts Summary

Construction and operation of the proposed drill site is not expected to cause significant impact as defined by the impact significance criteria to vegetation and associated resources. No wetlands occur at the drill site, less than 1 percent of the total AUMs within the Fish Creek C&H Allotment would be lost due to vegetation clearing, and the 2 acres of timber that would be cleared would be purchased by Amoco or sold at the current market rate.

Table 4-4 summarizes and compares the area of clearing and disturbance within each vegetation community type and associated loss of AUMs within the grazing units of the Fish Creek C&H Allotment for each access alternative. No reduction of AUMs within the Blackrock-Spread Creek C&H Allotment is anticipated as a result of implementing Alternative A or D1.

Of the road access alternatives, Alternative A would cause the least amount of vegetation clearing and disturbance. In addition, this alternative would cause the least amount of clearing and

disturbance of wetlands which would be considered significant as defined by the significance criteria. Alternative A would result in clearing approximately 6.8 acres of forest the majority of which is dominated by whitebark pine. The greatest disturbance of whitebark pine would occur under Alternative A. Similarly, Alternative A would cause the least impact to range resources of the access alternatives in terms of loss of forage and reduction of AUMs. However, none of the alternatives would significantly impact range resources as defined by the significance criteria.

Alternative B would cause a greater amount of clearing and disturbance of vegetation than Alternative C. However, the total area of clearing and disturbance of wetlands would be the same for both of the alternatives. Approximately 31.6 acres of forest would be cleared under Alternative B in contrast to 19.6 acres for Alternative C. Alternative C would impact range resources in terms of loss of forage and reduction of AUMs less than Alternative B.

The duration of impacts would be dependent on the time period required for a disturbed site to revegetate to pre-disturbance conditions. If the well were to go into production, then the portion of the drill pad not required during this phase would be revegetated. The balance of the disturbed site would remain unvegetated throughout the life of the project. Similarly, access roads would be revegetated as soon as possible after termination of the exploration phase. If the well went into production, then the access road would remain open to provide access to the well in addition to allowing the transport of oil out of the project area by truck. Impacts would remain throughout the duration of the production phase.

Implementation of Alternative D, helicopter access, would result in the least impact to vegetation and associated resources of all the access alternatives. Only minor amounts of vegetation would be cleared during road improvement. Construction of a 4-acre staging area within the sagebrush type would not be considered significant as determined by the impact significance criteria. However, if the Well were to go into production, then one of the road access alternatives would be implemented to facilitate transport of the product. Therefore, helicopter access would involve similar amounts of vegetation clearing and disturbance as discussed for the road access alternatives.

4.7.5 Cumulative Impacts

Construction and operation of the proposed project or associated access alternatives is not expected to cause significant cumulative impact to vegetation resources within the project area. Even with implementation of Alternative B, which would cause the greatest amount of vegetation clearing of all the road access alternatives, the cumulative amount of vegetation clearing would

Table 4-4. Summary of vegetation clearing and disturbance, in acres, by vegetation community type due to project implementation, and associated loss of livestock forage (AUMs/% total in allotment).

	Alternative				
	A	B	C	D1	D2
Uplands:					
Sagebrush	0.0	36.4	36.4	4.0	4.0
Upland meadow	16.7	9.5	11.8	4.0	4.0
Spruce-fir	3.2	22.5	14.1	2.0	2.0
Mixed pine	3.6	9.1	5.5	0	0
Total Uplands	23.5	77.5	67.8	10.0	10.0
Wetlands:					
Total Wetlands	2.5	8.5	8.5	0	0
TOTAL DISTURBANCE	26.0	86.0	76.3	10.0	10.0
Grazing Unit (Fish Creek Allotment):					
Breakneck	2/<1%	14/<1%	14/<1%	3/<1%	3/<1%
Red Creek	7/<1%	14/<1%	11/<1%	3/<1%	3/<1%
TOTAL	9/<1%	28/<1%	25/<1%	6/<1%	6/<1%

Alt. A - Assumes a 50-foot wide construction zone.
Alt. B & C - Assumes a 50-foot wide construction zone for existing roads requiring major reconstruction.
Alt. D1 & D2 - Clearing and disturbance only at drill site, man camp, and helicopter staging area.

be very small compared to the total area of undisturbed vegetation. Similarly, impacts associated with the implementation of Alternative A combined with the clearing that has occurred during timber harvest in the vicinity of the confluence of the South Fork of Spread Creek and Kettle Creek, and at the three previous sites of exploratory drilling would be very small compared to the total amount of undisturbed vegetation in the area.

4.7.6 Mitigation Summary

Most or all adverse impacts to vegetation and associated resources could be greatly reduced or avoided by revegetating disturbed areas as soon as possible after construction through the implementation of a site-specific revegetation plan. Trees, including whitebark pine, and shrubs should be transplanted into disturbed areas as part of the reclamation program and as directed by the Authorized Officer. A monitoring program should be implemented to determine when revegetation is complete as determined by performance standards as directed by the Authorized Officer. A noxious or undesirable weed control and eradication program would greatly reduce the potential for a significant impact resulting from invasion of these unwanted plant species. Amoco would be responsible for controlling noxious weeds and/or undesirable weed species. This should be coordinated with County Weed and Pest Control Board. Construction within wetland areas should be minimized by constructing staging areas adjacent to but away from wetlands thereby reducing the total area of disturbance required for constructing roads. Loss of timber resources could be minimized through direct compensation to the FS. Impacts to range resources could be minimized or avoided by revegetating disturbed areas as well as by maintaining or improving existing livestock control structures such as fences, cattle guards, and watering troughs. Any accidental death of livestock due to vehicle collision should be compensated by direct reimbursement of the permittee.

4.7.7 Unavoidable Adverse Impacts

Successful revegetation of cut and fill slopes in excess of 40 percent or in unstable soil areas may require repeated remedial reclamation efforts. However, no significant impacts to the vegetation resources would be expected following full and successful implementation of mitigation measures designed to reduce or avoid adverse and significant impacts. Therefore, no unavoidable adverse impacts are anticipated as a result of constructing and operating the proposed project or alternatives.

4.8 WILDLIFE

4.8.1 Introduction

Impacts to wildlife were noted as either related to habitat alteration or animal disturbance which included mortality. The relative acreage of habitat affected comprised a very small portion of the available habitat within the proposed project area for grizzly bears and big game. Loss of habitat would result in a slight reduction in forage for herbivores and temporarily displace some wildlife species. The major source of disturbance to wildlife would be in the form of increased traffic, both

vehicular and aerial. Disturbance would be particularly adverse during the winter months when animals are concentrated on winter range and are more susceptible to stress-induced mortality. Approval of a permit to drill must include consideration of seasonal stipulations to protect elk calving and elk and moose forage areas. An exception to this stipulation can be considered only after consultation between the proponent, the District Manager (BLM), the Forest Supervisor (FS), and the Wyoming Game and Fish Department (WGFD) during which a determination is made and agreed to that: 1) Seasonal conditions, and elk calving and elk and moose distributions and foraging area are such that they would not be significantly impacted; and/or 2) Additional measures are identified to appropriately mitigate significant impacts to elk and moose.

The grizzly bear also occurs within part of the area. This species is protected under the Endangered Species Act (ESA) and any action that could jeopardize its continued existence is prohibited by law from occurring. If compensatory measures are available, and they would prevent or preclude adverse impacts (e.g., seasonal restriction, other alternative, etc.), and if the U.S. Fish and Wildlife Service (FWS) concurs in this, then the action could be permitted. Consideration of compensative measures requires consultation between the proponent, BLM, FS, WGFD, and the FWS.

4.8.2 Impact Significance Criteria

Impact significance criteria were based on the best professional knowledge and opinions available. They were developed largely from information in scientific literature and existing guidelines and standards of government regulatory agencies. Where few or no published guidelines existed, the professional judgement of wildlife specialists was used.

Impacts to general wildlife species, including important game species, would be considered significant if:

- The area of disturbance within a riparian habitat exceeded 1 percent of the total acreage of riparian habitat within the lease area.
- An officially designated critical habitat was impacted during an important use period.
- The area of disturbance within an officially designated critical habitat exceeded 1 percent of the total acreage of that habitat within the region.
- Wildlife mortality such as road kills, poaching, or harassment attributable to project activities exceeded existing levels by 15 percent.

- Habitat effectiveness, as measured by the cumulative effects computer model developed by FS staff of the Bridger-Teton National Forest, is reduced by more than 10 percent.

Impacts to species of special concern such as federally listed threatened or endangered species, species proposed for listing, FS or State sensitive species and federal candidate species would be considered significant if:

- Loss of any federal and/or state listed endangered, threatened, proposed, or candidate species occurs.
- Disturbance to any of the above noted species resulted in a reduction in recruitment to their populations.
- Loss or disturbance of designed critical habitat of the above noted species exceeded 1 percent of the habitat supporting a viable population.
- A "may affect" determination was reached by the FS in the Biological Assessment required by Section 7 of the Endangered Species Act of 1973 (as Amended).
- Habitat effectiveness, as measured by the cumulative effects computer model developed by FS staff of the Bridger-Teton National Forest, was reduced by more than 10 percent.

4.8.3 Direct and Indirect Impacts

4.8.3.1 Drill Site

The proposed drill site is not located within wildlife habitat designated as critical. However, the drill site would be located in areas containing elk migration corridors (Exhibit 3-7). Drill site construction and operation activities could impact elk migration.

Approximately 2 acres of spruce-fir habitat and 4 acres of upland meadow habitat would be eliminated and the construction and operational activities at the site during the late spring, summer, and fall may deflect use by some species such as elk, bears, and coyotes into adjacent less disturbed habitats. These impacts would not be considered significant.

4.8.3.2 Access Alternatives

4.8.3.2.1 Alternative A

General Wildlife

Moose: The principal short-term potential impact of Alternative A on moose is associated with vehicular encounters with these

animals on their winter range. During the winter months moose tend to utilize plowed roads as movement corridors and may become unduly stressed from repeated attempts to avoid vehicles, either by running ahead of them in the road, or by lunging off the road into deep snow. Regular snow removal from the access road may increase big game winter use of some of the area by enhancing accessibility. The proposed access route would traverse 1.2 miles of moose winter range. This potential impact would be adverse.

A secondary potential short-term impact is the increased possibility of vehicle-moose collisions during the summer and fall months. The probability of this type of impact is increased if night-time travel occurs. This too would be an adverse impact.

Elk Migration: Exposure of migrating elk to humans would be increased by opening up, reconstructing, and newly constructing approximately 9 miles of road that intersects migration corridors and by increasing vehicular traffic levels on 12.9 miles of existing open road. Increased access along the 9 miles of newly created road could increase hunting pressure if the roads were used by the public. Public access is not planned but unauthorized use by hunters is a possibility. Results of such access may lead to increased elk harvest, a shift of feeding and movement activities to nocturnal hours. Also, there is an increased probability of elk/vehicle collisions associated with greater traffic levels on existing roads and the opening up of new areas to traffic. Night-time traffic poses the greatest risk to animals. These impacts would be significant.

Other Wildlife Species: The roads associated with Alternative A are not expected to significantly impact other wildlife in the area. The potential for vehicle-wildlife collisions would be increased slightly, particularly for slow-moving (porcupines), inconspicuous (rodents), and nocturnal (skunks) species. A small amount of habitat of rodents, reptiles, amphibians, and ground-nesting or foraging birds would be temporarily removed during road construction. This removal of vegetation would displace a few individuals. These impacts would be adverse.

Species of Special Concern

Grizzly Bears: Alternative A deals with Management Situations 1 and 2 for grizzly bears, i.e., Grizzly Habitat types 1 and 2, as defined in Chapter 3, are involved. Approximately 7.9 miles (38%) of this access pass through MS-1 while 12.9 miles (62%) straddle the boundary between MS-1 and MS-2 (Exhibit 3-5). Short-term impacts of Alternative A on grizzly bears are associated with reopening 5.7 miles of existing road, reconstruction of 1.5 miles of previously existing road, and construction of 1.8 miles of new road. The potential for impacts is greatest

during the spring, summer, and fall months since bears would be denned during the winter months of the operation.

The physical removal of vegetation along the 1.5 miles of reconstructed road and the 1.8 miles of new construction would temporarily eliminate some herbaceous forage. These impacts would carry over into subsequent seasons depending on the success of revegetation and reclamation efforts. Impacts include the temporary loss of small amounts of herbaceous forage, increased displacement during spring through fall months, and a potential increase in human/bear encounters. However, the loss of grizzly bear forage (pine nuts) provided by whitebark pine and utilized by bears in the fall would be considered a long-term impact due to the 100 to 200 years required to regenerate these trees. The magnitude of this impact on grizzly bears would be small considering the relative area that would be disturbed and the remaining undisturbed habitat in the region. However, this impact is considered adverse.

The potential for human/grizzly encounters during the spring, summer, and fall months would be increased by opening 9.0 miles of new access road and maintaining drilling crews on the well site. If such encounters led to the death or injury of a bear or loss of human life, this would be considered a significant impact.

The principal cause of potential impacts to bears from this project would be increased levels of human activity in the area. During the spring, summer, and fall months, construction activities and associated traffic may displace bears into adjacent undisturbed habitats. A higher density of roads in the Spread Creek drainage would allow access into important grizzly habitats. The cumulative effect of existing and proposed activities could be adverse to the recovery of the grizzly bear.

Long-term impacts to the grizzly bear, which would result in a conclusion that the action "may affect" the continued existence or survival of the grizzly in this area, would result only if the well went into production or if a new or improved access road was maintained for public use. In the event of such a development, the short-term impacts previously described would likely increase and be perpetuated.

Whooping Cranes: Cranes have been sighted to the north and west of existing roads in the project area. Because there have been no cranes sighted since 1983, the proposed operation is not expected to impact whooping cranes (Lockman 1986, 1987).

4.8.3.2.2 Alternative B

Alternative B would traverse 29.4 miles of elk and moose winter range, 16.2 miles of bighorn sheep and mule deer winter range,

and 13.0 miles of elk calving habitat. In addition, the existing portion of the access road passes adjacent to two winter feeding grounds for elk and nesting areas of the bald eagle and trumpeter swan.

General Wildlife

Big Game Winter Range: Vehicular encounters with wintering big game animals is a major concern associated with Alternative B. Since the existing road is not normally plowed during the winter, opening it up for project-related traffic and snow plows would constitute a major change in the winter environment for big game. Some unauthorized use by the general public may also occur. Specific details on traffic increases can be found in the Transportation Section in this chapter.

Introduction of winter traffic to the area could impact wintering big game in several ways. Elk may alter their movement and range utilization patterns and ultimately use range that is less favorable to their survival. Physiological stress may result which could lead to direct and indirect mortality.

Moose tend to utilize plowed roads as movement corridors during the winter months and may become unduly stressed from repeated attempts to avoid vehicles. Moose either run ahead of vehicles in the road, sometimes for long distances, or lunge off the road into deep snow.

Bighorn sheep and mule deer also utilize plowed roads as movement corridors and experience more difficulty than moose when they lunge off the road into deep snow to escape vehicles. Channeling vehicular traffic through big game winter range greatly increases the likelihood of collisions with vehicles. The probability of collisions with big game animals is greater with night-time traffic. Individual animals would also likely become physiologically stressed as a result of vehicle avoidance, changes in movement and range use patterns, and general disturbance during the critical wintering period. Stress can lead to increased overwinter mortality and reduced productivity.

Direct and indirect losses to overwintering big game animals as a result of implementing Alternative B would likely constitute a significant impact.

Elk Migration: Constructing 6.0 miles of new road that intersect migration corridors and increasing vehicular traffic levels on 37.1 miles of existing open road would increase exposure of migrating elk to humans. An increase in hunting pressure would result if the 6 miles of newly created access roads were left open to the public. Although the 9 miles of newly created access would be off-limits to the general public, there is a potential for unauthorized use. More access would potentially increase the

elk harvest in the area and cause the elk to shift their major feeding and movement activities away from the new roads. Also, peaks of diurnal activity patterns may shift to nocturnal hours. In addition, the probability of vehicular/elk collisions would increase on existing and new roads. Direct mortality due to such collisions would be considered a significant impact. Night-time traffic would pose the greatest risk to animals.

Elk Calving Range: A total of 13.0 miles of existing road passes through elk calving range. During the elk calving season (May 1 through June 30) pregnant elk and cows with newborn calves may be displaced into adjacent habitats for concealment. This would be especially likely if vehicles stop along the road or out-of-vehicle activities occur. This would be an adverse impact.

Other Wildlife: The proposed road is not expected to significantly impact other wildlife in the area. The potential impacts are the same as those discussed under "Other Wildlife" for Alternative A.

Species of Special Concern

Bald Eagle and Trumpeter Swan: It is not anticipated that the proposed construction and operation would impact nesting activities of the bald eagle or the trumpeter swan since these nests are located far enough off the existing road so traffic has not, in the past, interfered with normal breeding and nesting activities.

Peregrine Falcon: No impacts are anticipated to the peregrine falcon since the area they have been using is located far enough off the existing road that traffic has not, in the past, interfered with their normal activities.

4.8.3.2.3 Alternative C

Potential impacts resulting from Alternative C would involve wintering big game, elk calving activities, nesting activities of the bald eagle and trumpeter swan, and general wildlife concerns. These impacts are identical to those discussed for Alternative B, but the amount of habitat affected is slightly less. Alternative C would traverse 28.3 miles of elk and moose winter range, 16.2 miles of bighorn sheep and mule deer winter range, and 13.0 miles of elk calving habitat.

4.8.3.2.4 Alternative D

Northern Staging Area (D1).

General Wildlife

Moose: Impacts to moose resulting from development of access

roads would be similar to those described for Alternative A. The helicopter would not be flying over moose winter habitat and no impacts associated with its operation are expected.

Elk Migration: During the set-up and drilling phase of the project, exposure of migrating elk to humans would be increased by 1) opening up 3.6 miles of existing road not currently in use; 2) continuous operation of a helicopter staging area; 3) continuous flights of a helicopter along 3.8 miles of air corridor; and 4) increasing ground vehicle traffic levels on 12.9 miles of existing open road.

The principal cause of potential impact to migrating elk would be the fright reaction of elk to the continuous operation of the large helicopter across their migration corridors. Available evidence indicates that wild ungulates in general exhibit stronger flight reactions to helicopters than to either ground vehicles or fixed-wing aircraft (Bromley 1985). Some of the rationale for this strong reaction is presented later, in the grizzly bear discussion. For the reasons stated therein, it is probable that the magnitude of elk displacement caused by exposure to the helicopter would be much greater than that resulting from exposure to road vehicle traffic. This would be a significant impact because of the potential for inducing high levels of stress.

A secondary potential impact would be the increased probability of vehicular collisions with elk caused by the greater traffic levels on existing roads and the opening up of new areas to traffic, particularly at night. The additional 3.6 miles of access would increase the potential for unauthorized hunter access. This could increase the elk harvest in the area, which could cause the elk to shift their major feeding and movement activities away from the newly opened road, and to the hours of darkness. This would be an adverse impact.

Other Wildlife: Impacts to other wildlife species would be similar to those described under Alternative A.

Species of Special Concern

Whooping Crane: The helicopter would be operating at least 7 miles south of the areas in which whooping cranes have been sighted. Therefore, no impacts are expected to this species.

Grizzly Bear: Impacts to grizzly bears associated with the access road would be similar to those described under Alternative A, but would involve 4.6 miles in MS-1 and 12.9 miles bordering MS-1 and MS-2. The staging area pad for the helicopter is located within grizzly bear MS-1 habitat and, from there, the aircraft would

shuttle back and forth to the drill site across 3.8 miles of MS-1 habitat.

Wildlife species in general, and grizzly bears in particular, tend to exhibit strong fright reactions to helicopters (Harding and Nagy 1980, Klein 1973, Schallenberger 1980, USDI 1976). This is probably because helicopters present a number of strong stimuli that tend to cause adverse reactions in wild animals. Specifically these stimuli include: 1) loud noise (Ames 1978, Luz and Smith 1976, Owens 1977); 2) visual stimulation in conjunction with noise (Busnel 1978, McMillan 1954, Thomson 1972); 3) low altitude operation (Banfield 1971, Barry and Spencer 1976, Klein 1973); and 4) an experience to which most wildlife have not adapted (Berger 1977, Knight 1980, Miller and Gunn 1980). The type of helicopter that would be used is a large craft of the Sikorsky S-64 or Boeing Vortol 114 class. The craft produces noise levels of 100 to 140 decibels (Rodrigues and Luchetta 1981). There is some experimental evidence that it is difficult or perhaps impossible for animals to adapt to noise levels of 100 decibels and greater (Ames 1978). Disturbances from helicopter use as planned would likely be a significant impact.

Compared to large helicopters, ground vehicles present much lower levels of noise which are insulated by adjacent forest vegetation, a less visible form of motion, and a type of human activity that is more familiar to grizzly bears.

Southern Staging Area (D2).

General Wildlife

Big Game Winter Range: Impacts to bighorn sheep and mule deer winter range would be identical to those described for Alternatives B and C. Access roads would traverse 20.5 miles of elk and moose winter range with the resulting impacts similar to those described for Alternatives B and C. The helicopter staging pad would be located within elk and moose winter range two miles from one of the winter feeding areas for elk. While the elk using this feeding area would probably adapt to the helicopter operation in time, they would sustain some initial stress and would probably be displaced from the area of helicopter operation (staging pad and shuttle flight line) for the duration of the winter. This would be an adverse impact.

Elk Migration: During the set-up and drilling phase of the project, exposure of migrating elk to humans would be increased by: 1) continuous operation of a helicopter staging area, 2) continuous operation of a helicopter through an air corridor at least 4.8 miles long, and 3) increasing ground vehicle traffic levels on 30.8 miles of existing open road. The impacts resulting from this development would be similar to those discussed for the Northern Staging Area.

Elk Calving Range: The 13.0 miles of access road leading to the helicopter pad normally sustains traffic during the elk calving season. Therefore, additional vehicles associated with the drilling operation should not cause changes in elk use of the habitat unless vehicles were stopped regularly, or out-of-vehicle activity occurred. The use of the helicopter staging pad, which is located within elk calving habitat, would displace pregnant cows and cows with calves if the operation of aircraft closely approached or extended into elk calving season (May 1 through June 30). There is growing evidence that wild ungulates are particularly sensitive to overflight by low-flying aircraft during the birthing and nursery season (Berger 1977; Calef, et al. 1976; Klein 1973).

Other Wildlife: Alternative D2 would have impacts on other wildlife similar to those previously described for the Alternatives B and C, but would involve less roadway.

Species of Special Concern

Bald Eagle and Trumpeter Swan: Proposed helicopter operations would be far removed from the known nesting areas of the bald eagle and trumpeter swan. Therefore, no impacts are expected. These nests are located far enough off the existing road leading to the helicopter pad so that vehicular traffic is not expected to interfere with normal breeding and nesting activities.

Peregrine Falcon: Proposed helicopter operations would be far removed from the known area of use of peregrine falcons and no impacts are expected. The area they have been using is located far enough off the existing road that traffic has not, in the past, interfered with their normal activities.

4.8.4 Impacts Summary

Environmental consequences to wildlife are summarized in Table 4-5. Accessing the drill site from the north would cause less overall impact to wildlife for the reasons summarized below:

The northern road alternative (A) and helicopter alternative (D1) are not associated with, for the most part, big game winter habitat. Few big game animals remain during the winter months. Only a few moose are present in two small patches of habitat along the existing access road. Grizzly bears would hibernate during the winter and very few other species of wildlife remain in this area through the winter. The summer and fall months, when the operation would commence activities, are not critical times for wildlife species using the area. Wildlife species are not concentrated at this time of year and they have many habitat alternatives.

Table 4-5 Summary of Environmental Consequences to Wildlife

	Project Alternatives (miles)				
	A	B	C	D1	D2
Road Miles through Wildlife Habitats					
- Grizzly 1	7.9	0.0	0.0	4.6	0.0
- Grizzly 1-2 interface	12.9	0.0	0.0	12.9	0.0
- Total Grizzly	20.8	0.0	0.0	17.5	0.0
- Moose winter range	1.2	29.4	28.3	1.2	20.5
- Elk winter range	0.0	29.4	28.3	0.0	20.5
- Elk migration	9.0	6.0	6.0	0.0	0.0
- Bighorn Sheep/Mule Deer winter range	0.0	16.2	16.2	0.0	16.2
- Elk calving habitat	0.0	13.0	13.0	0.0	12.3
Reduction in habitat effectiveness for grizzly bear and elk					
- Summer	2.0%	2.5%	1.5%	0.0%	0.0%
- Fall	1.9%	2.4%	1.3%	0.0%	0.0%
Impact Significance Criteria					
- Impact critical habitat during season of use	Yes	Yes	Yes	Yes	Yes
- Habitat effectiveness reduced >10%	No	No	No	No	No
- Disturbance to >1% of critical habitat	No	No	No	No	No
- Disturbance to >1% of riparian habitat	No	No	No	No	No
- Wildlife mortality up >15%	No	No	No	No	No
- "May Effect" determination on T & E species	No[1/]	No	No	No	No

1/ Contingent upon strict application of mitigation measures described in this report.

Alternative A would cause less impact than the helicopter alternative (D1) because: (1) the helicopter alternative adds the impacts of loud noise, high visibility, and continuous aircraft operation while not significantly reducing the need for road construction work; and (2) the establishment of a stationary center of human activity in the form of the helicopter staging pad would be more disruptive to wildlife than ground vehicles which pass through the area without stopping.

Both of the southern access road alternatives (B and C), as well as the helicopter alternative (D2), would require the snowplow opening of a minimum of 18.7 miles of existing road that passes through the center of winter range of four species of big game animals. Opening this road, which is normally unplowed during the winter, would expose big game to additional levels of human activity beyond snowmobiling and associated outdoor winter recreation that they are not accustomed to during the most critical season of the year. It would also create the problem of controlling public access on this opened road. Public use of the road during the winter months would magnify impacts to big game.

4.8.5 Cumulative Impacts

A computer model designed to determine cumulative impacts to bears has been developed and is being used within the Yellowstone area. Since the project area has yet to have the necessary data base inventoried, this model could not be used for the current analysis. An elk model (Leege 1984) was utilized as a replacement because the factors employed in this model are also important in determining the quality or effectiveness of grizzly bear habitat. These parameters are: 1) miles of open roads per square mile, 2) levels of traffic on these roads, 3) forage/cover ratios, and 4) interspersion of forage and cover. Since the major source of potential impacts involved on this project are associated with: 1) new road construction, and 2) increased traffic levels on existing roads, the elk model would provide analyses that would be helpful in assessing impacts on grizzly bear habitat. Results of the analyses are shown in Table 4.6 for summer and fall scenarios. The difference in habitat effectiveness in the analysis area is limiting due to road densities in excess of one mile per sqaure mile.

The Biological Assessment, Appendix E, describes the details of the methodology used to analyze cumulative effects and the results of the analysis. The area included in the cumulative effects analysis encompassed those areas of designated grizzly bear habitat that contain or are adjacent to roads proposed for use in accessing the drill site. The analysis area includes 73,776 acres (115.3 square miles). The overall percent forage-/cover ratio on the analysis area is 56/44 and did not change as a result of the proposed operations and developments. Since forage/cover interspersion values did not change, the results of

Table 4-6. Changes in current summer and fall levels of habitat effectiveness for both elk and grizzly bear on the analysis area associated with proposed access alternatives.

Alternative	Standard Road Miles	Carrying Capacity	HEV*	% Reduction
		SUMMER		
Current Situation	69.5	665	58.9	0.0
Alternative A	73.8	653	57.7	2.0
Alternative B	74.2	648	57.4	2.5
Alternative C	72.0	655	58.0	1.5
		FALL		
Current Situation	66.7	672	59.4	0.0
Alternative A	70.9	659	58.3	1.9
Alternative B	71.3	655	58.0	2.4
Alternative C	69.1	662	58.6	1.3

* - Habitat Effectiveness Value

the analyses were determined entirely by: 1) miles of new roads proposed and 2) increases in traffic levels on existing roads.

An Addendum to the Biological Assessment, provides additional analysis presented in Appendix E, and demonstrated that with closure and reclamation of existing roads within MS-1 areas inthe analysis area, the impacts on the grizzly bear associated with the construction and operation of Alternative A would be fully mitigated. Thus, a "no effect" with implementation of conservation and protection measures, was concluded.

Amoco's cooperation with the FS in their program of restricting access and closing other existing roads in the cumulative effects analysis area would help to reduce or compensate for road impacts associated with the drilling operation.

Increased levels of use by the general public would occur if any of the new or reopened access roads associated with the proposed operation were left open. Some forms of human activities that might be expected to increase include all-terrain vehicle

traffic, firewood cutting, hunting, fishing, poaching, hiking, and picnicking.

Such increases in general public use have the potential for substantial cumulative impact in some areas at certain times of the year. If the existing southern access road were plowed every winter and remained open for public use, the increase in vehicular traffic could adversely impact wintering big game animals. However, the big game in this area may already be accustomed to existing human activity including snowmobiling and feed ground maintenance. Conversely, if the reopened, reconstructed, and new sections of the northern access road remained open for public use during the spring, it would increase the potential for human-grizzly encounters.

4.8.6 Mitigation Summary

The following mitigation measures are recommended in order to minimize the significant impacts to the various categories of wildlife noted in Section 4.8.3. Although the mitigation measures mainly addresses those impacts that were determined to be significant, many of them would also reduce the adverse impacts that were identified.

4.8.6.1 Drill Site

Suggested mitigation measures to minimize impacts at the proposed drill site include:

- In the event of a "dry hole", reclaim the wellpad site and adjacent disturbed habitat to approximate pre-project levels for vegetative cover and physical condition.

- Minimize the potential for attracting bears by following the prescribed Interagency Grizzly Bear Guidelines for food handling and storage and the disposal of garbage.

- Inform and educate project personnel in regard to actions and circumstances that are likely to result in human-bear encounters and the measures that can be taken to minimize the potential for such encounters.

- If the site is a producer, transport the product off-site via pipeline rather than by truck in order to minimize displacement of grizzly bears and also reduce the potential for grizzly bear-human encounters.

- If the well is a producer and operations continue, initiate a program to monitor effects on grizzly bears.

4.8.6.2 Access Alternatives

The following mitigation measures are presented in order to eliminate or substantially reduce impacts associated with access alternatives. The measures are grouped by wildlife category and reflect the significant and adverse impacts noted in Section 4.8.3.

General Wildlife

- Impose speed limits on access roads to reduce the incidence of animal vehicle collisions.

- Either prohibit night travel on access roads or, if night travel is necessary, further reduce the speed limit for such travel.

- Require regular drivers to undergo a training session describing the type of wildlife in the area that is susceptible to vehicular collisions, the circumstances under which such collisions are likely to occur, and the measures that can be employed to minimize them.

- Prohibit public access to reopened, reconstructed, and new roads utilized during this operation.

- Since road densities in the region are already high, cooperate with the FS in their program of restricting access and closing some of the roads in the project area.

- In the event of a "dry hole", reclaim all new roads constructed during the project to approximate original contours.

- During reclamation of operation areas, establish a variety of forage species that are useful to resident herbivores.

- To the extent possible minimize the physical disturbance of critical vegetation habitats such as riparian areas or whitebark pine stands.

Big Game

- To facilitate big game movements and minimize the potential for injuries, do not fence road access rights-of-way.

- Where access roads are used during the winter months in big game winter range, plow and maintain escape openings every 200 yards to facilitate the easy exit of moose and other big game animals.

- To minimize displacement and stress of animals, prohibit vehicles from stopping, except for emergencies, in big game winter habitat while there is snow on the ground and in elk calving habitat between May 1 and June 30.

- Prohibit construction work, extensive use of ground crews, and helicopter operation within or over designated elk calving habitats between May 1 and June 30.

Grizzly Bear (Applicable to Alternative A only)

- In the event of a "dry hole", reclaim the wellpad site and adjacent disturbed habitat to approximate pre-project levels for vegetative cover and physical condition.

- Avoid or minimize spring season activities in riparian habitats on the project area.

- Same as the second item for drill site above. In addition, during spring, summer and fall months, minimize out-of-vehicle activities, prohibit offsite activities, feeding of wildlife, and stopping along the access road except for required work and emergencies.

- Report sightings of grizzly bears and their sign to regulatory authorities and cooperate in their bear management programs.

- Avoid removal of whitebark pines where possible. Replace any whitebark pines removed during construction with seedlings or transplant stock from adjacent areas when the operation areas are reclaimed.

- If the well is a producer, and the operation continues, additional biological assessment and consultation with the FWS will be required. The FS will maintain an ongoing program to monitor effects on grizzly bears.

- Close the identified existing roads itemized in Appendix E to all vehicular traffic and reclaim/revegetate these roads within MS-1 areas in the analysis or mitigation area thereby reducing road densities to 1.0 mile per square acre or less.

- o If the well goes into production, transport the oil by pipeline to reduce truck traffic along the access roads and the associated impact to the grizzly bear.

- o Minimize maintenance traffic during production including vehicular speeds.

4.8.7 Unavoidable Adverse Impacts

Unavoidable impacts that would occur throughout the life of the project on one or more of the alternatives include: 1) loss of some wildlife habitat; 2) some increase in potential for vehicle related wildlife injuries, stress, and mortality; 3) the displacement of sensitive wildlife species from some habitats; 4) some increase in potential for encounters between grizzly bears and humans; and 5) some increase in potential for disruption and mortality of wildlife from use of the area by the general public. Implementation of mitigation a summarized previously and as presented in Chapter 6 would fully mitigate or reduce all significant impacts to levels not considered significant.

4.9 VISUAL RESOURCES

4.9.1 Introduction

Short-term visual impacts associated with drilling typically include visual contrasts between the industrial character of the drilling rig and the characteristic landscape. In addition, heavy volumes of truck traffic and fugitive dust may also become negative visual impacts. Long-term visual impacts may be associated with access road construction, and if the well is productive, production facilities and associated transport of the product by truck.

Both short-term and long-term impacts are associated with contrasts in area, line, form, color, and texture of the characteristic landscape, and the equipment and construction-related consequences of drilling activity. The duration of impact depends on the time required to return the disturbed site to a predisturbance condition. In general, sites where mitigation is difficult and/or where visual contrasts are highly visible to potentially large numbers of viewers, impact would be most severe.

4.9.2 Impact Significance Criteria

A visual impact is considered significant if it exceeds the level of visual change permitted within the objectives of a given Visual Quality Level. Combined effects of the project would be significant where the proposed action in conjunction with present

actions and potential future actions permitted under present management direction would create changes in overall character from 1) man - natural mix to man dominated, or 2) from scenic natural to man - natural mix, or 3) from common natural to man dominated, or 4) from common natural to man - natural mix. (refer to Appendix C-2 for definitions of these classifications).

4.9.3 Direct and Indirect Impacts

4.9.3.1 Drill Site

In the short term, the visual management objective of Partial Retention, as designated by the FS, would not be achieved during the drilling operation when the drill rig and man camp were on-site. Thus, visual impacts would be significant. The size, form, and possible color of the rig and man camp would dominate the immediate environment in the short term. Exhibit 4-1 illustrates the viewshed that would be visually impacted by the proposed drill site and man camp (approximately 1,600 acres). Construction of the drill pad would necessitate the removal of vegetation and extensive cut (approximately 36 ft.) and fill (approximately 25 ft.), which would result in substantial changes in area, line, form, color, and texture, adding to the visual impact associated with the rig and worker camp.

In the long term, removal of the drill rig, reclamation of the pad to near original contour, and successful revegetation of the site could bring the drill site up to visual management objectives for Partial Retention classification. However, strict compliance with the objectives of Partial Retention could not be achieved over a short time period. No indirect impacts resulting from construction of the drill site are expected.

4.9.3.2 Access Alternatives

4.9.3.2.1 Alternative A

The minor improvement of the existing Flagstaff Road from U.S. Highway 26-287 to the confluence of Kettle Creek and the South Fork of Spread Creek would not result in significant impact. The improvement would occur in areas previously disturbed.

Construction of access road from the South Fork of Spread Creek to the drill site would traverse approximately 2.2 miles of areas delineated as Modification, and 1.1 miles of areas delineated as Partial Retention. Road construction within areas delineated as Modification would not violate the objectives of the classification, and therefore no significant impacts would result.

The construction of new road within areas delineated as Partial Retention would be the most substantial impact associated with Alternative A. The removal of vegetation, and the cuts and fills

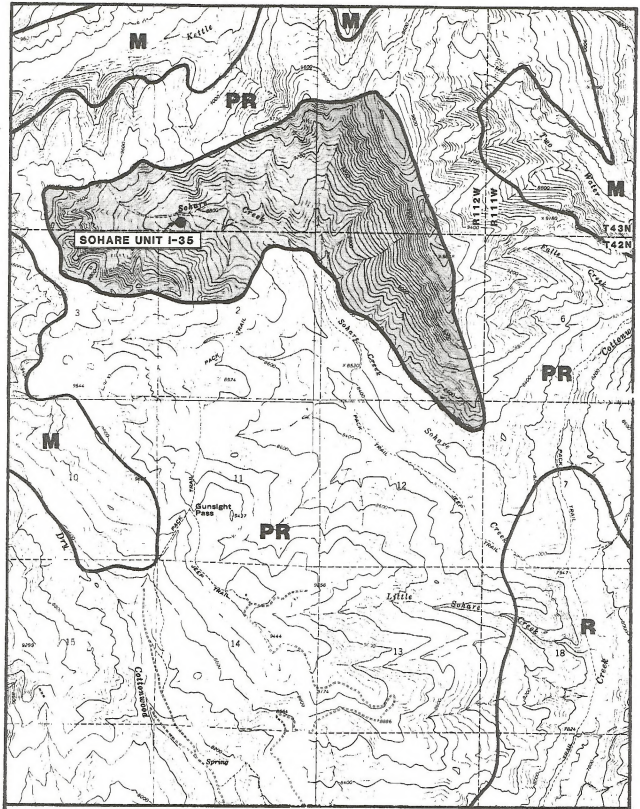


Exhibit 4-1.

AREA WITH VISUAL ACCESS TO DRILL SITE 1-35.

VISUAL QUALITY LEVELS[1]

R - Retention
PR - Partial Retention
M - Modification

1-Terms Defined in Appendix C-2.

0 1/2 1 Mile

related to construction of the new road would produce visual contrasts in area, line, form, color, and texture with the characteristic landscape. Since road construction would traverse mountainous terrain, cut and fill slopes would cover large areas. These areas would be highly visible, and thus would be considered significant. The impacts associated with new road construction would be significant because they would exceed the objectives of the Partial Retention classification for this area. However, if vertical and horizontal alignments of the road were made in such a way as to minimize alteration of the topography and existing vegetation, and take advantage of trees, shrubs, and natural terrain to screen visual contrast, impacts could be substantially reduced.

Short-term impacts resulting from access road construction would include increased traffic, vehicle movement, noise, and dust. However, these impacts (with the exception of dust) would be allowed within the objectives of Partial Retention for this area. The potential dust problem could be reduced through recommended mitigation such as the application of water as a particle binder. These impacts would be considered short-term, unless the well was productive. No indirect visual resource impacts resulting from construction of Alternative A are expected.

4.9.3.2.2 Alternative B

The minor improvement of the Gros Ventre Road and the existing road to near Breakneck Creek would not result in significant impact due to increased contrast in area, line, form, color, and texture with the characteristic landscape. The improvement would occur in areas previously disturbed. The route is located in high sensitivity areas over its entire length. As the road enters the Gros Ventre River Valley, the potential of visual impacts due to increased dust and numbers of vehicles would extend to large areas over long distances. The Gros Ventre Road travels through Unique variety class and Foreground High sensitivity level and distance zone. This section of roadway is heavily used by numerous summer and winter recreationists as the principle access to Red Hills and Crystal Creek campgrounds. Increased use of the road by construction vehicles and crews during construction and the drilling period would also have deleterious affects to the visual resource. Moving vehicles are very visible for long distances, especially when dust is associated with that movement. These impacts are basically short term, but road improvement could encourage more recreation traffic through the upper Gros Ventre Region, resulting in a long-term impact.

Major road reconstruction along Cottonwood Creek and new road construction from the end of Cottonwood Creek Road to the proposed drill site would traverse approximately 6.6 miles of areas delineated as Retention and 6.6 miles of areas delineated as Partial Retention. Physical changes required by this construc-

tion would produce contrasts in area, line, form, color, and texture with the characteristic landscape that would exceed the objectives of both Partial Retention and Retention delineations. These impacts would be considered significant.

Since the majority of the route from Cottonwood Creek to the drill site would traverse steep slopes, the size of the cut and fill slopes would be substantial and highly visible.

Visual impacts due to increased road use, noise, and dust associated with construction and operation of the access road would also exceed visual quality objectives for Retention areas, but not Partial Retention areas as previously discussed under Alternative A. With the exception of dust control, these impacts could not be mitigated during the estimated 120-day construction and drilling period. These impacts would be short term but could become long term if the well was productive.

No indirect impacts resulting from the construction of Alternative B are expected.

4.9.3.2.3 Alternative C

The impacts that would occur to the visual resource due to construction and operation of this alternative would be very similar to those described for Alternative B up to the point of route departure from Alternative B at Sohare Creek. Major road reconstruction and new road construction would traverse approximately 5.0 miles of areas delineated as Partial Retention and 6.6 miles of areas delineated as Retention. Construction activities would result in substantial contrasts in area, line, form, color, and texture with the surrounding undisturbed landscape. Visual impacts would be similar to those associated with construction of Alternative B, and would be substantial enough to exceed Partial Retention and Retention objectives and therefore would be considered significant.

No indirect impacts resulting from the construction of Alternative C are expected.

4.9.3.2.4 Alternative D

Construction of the Northern (D1) or Southern (D2) helicopter staging areas would result in visual impacts similar to those described for construction and operation of the drill site. Both sites would require vegetation removal, extensive grading and land leveling to produce a flat area of approximately 4 acres. Contrasts in area, line, form, color, and texture from these activities would be visible.

Northern Staging Area (D1). The D1 Staging Area would be located in a zone rated Modification. Site disturbance impacts associated

with construction have been described above. The impacts would not exceed the objectives for Modification and would not be considered significant. However, the use of the pad by helicopters would be frequent enough during construction to create visual impacts that would be significant in that Modification objectives would be exceeded in the short term. The landing pad could be reclaimed to Modification objectives. Approximately 18 miles of existing roads described under Alternative A would be used to access the site with similar impacts. No indirect impacts associated with this alternative are expected.

Southern Staging Area (D2). The D2 Staging Area would be located in an area delineated as Partial Retention. The size, configuration, and use of this site would create visual impacts that would exceed Partial Retention objectives in the short term. Through successful application of reclamation procedures, impacts could be reduced to meet Partial Retention objectives. Approximately 23 miles of existing roads would be used to access the site. Impacts associated with access to the site would be similar to those described for Alternative B.

4.9.3.3 Impacts Summary

In summary, the impacts associated with construction of the drill site (and drilling activities) would be significant because they would exceed the objectives of the visual quality levels established by the FS in the short term. However, in the long term, the proposed actions could meet current specified visual quality objectives if reclamation was implemented successfully. In contrast, if the well was to go into production, visual impacts associated with the drill site and access to the drill site would be significant for the life of the production phase.

Construction of the new road associated with Alternative A would have a significant impact on the visual resource because it would exceed Partial Retention objectives along 1.1 miles of its route. Careful design and construction of the road would help reduce these impacts. Over its entire length, the portion of the Alternative A route requiring new construction is approximately 9.9 miles shorter than Alternative B and 8.3 miles shorter than Alternative C. Much of the Alternative A and B routes would traverse Partial Retention and Retention delineations which would be considered to be significant. The cumulative distance of steep sideslope construction is shorter along Alternative A than Alternatives B and C. This alternative would traverse areas not as heavily used by recreationists as in the Gros Ventre River Valley, and the drainages this alternative would traverse are rather narrow, thus limiting visual access. Both short-term and long-term visual impacts would be fewer along this route than any other surface route, even under a productive well scenario.

Construction associated with the Alternative B route would require the greatest length of new road and would involve 6.6 miles of construction within areas delineated as Partial Retention and 6.6 miles of areas delineated as Retention. This would cause significant adverse impact to the visual resource because it would exceed the level of visual change permitted and it would change the overall character of the landscape.

Construction of the new road and major road reconstruction of Alternative C route would involve less mileage of Partial Retention (5.0 miles), and the same mileage of Retention (6.6 miles) as Alternative B. The portions of this route not common with Alternative B would be less visible from the adjacent landscape than Alternative B.

Construction of the Northern (D1) helicopter staging area would have the fewest adverse impacts on the visual resource in both the short and long term of the two helicopter staging areas under consideration.

Helicopter access would cause the least visual impact of all alternatives under consideration. Either helicopter staging area would produce fewer long-term impacts because neither would require any additional new road construction. Impacts from either helicopter access would adversely impact recreationists using the immediate area or areas with visual access to the staging areas. Successful reclamation of the helicopter landing pads through regrading and revegetation would meet either Modification or Partial Retention objectives.

4.9.4 Cumulative Impacts

Past disturbances to the visual resources in the immediate area have been minimal, with the exception of timber harvest operations in the South Fork of Spread Creek drainage and at the three exploratory drill sites previously constructed (Jann 1987). However, since these activities are dispersed throughout the project area in combination with the comparatively small disturbance associated with construction and operation of the proposed project or alternatives (26.0 acres, 86.0 acres, 76.3 acres, and 10 acres for Alternative A, B, C, and D, respectively), no significant cumulative impacts to visual resources are anticipated.

4.9.5 Mitigation Summary

During site construction and drilling, care should be taken to maintain and protect existing site screening by removing as few trees and large shrubs as possible; site disturbance in general should be minimized. After completion of well construction and drilling operations, recontouring the pad and revegetation is recommended to minimize long-term impacts. If the well is a

producer, maximum pad area should be reclaimed and all facilities painted a color that harmonizes with the natural environment.

To reduce the short-term impacts associated with road construction, it is recommended that steps be taken to minimize fugitive dust (e.g., water roads, gravel, 15 mph speed limit). During construction, care should be taken to protect all existing vegetative cover, trees and shrubs in particular, at the edge of the right-of-way. Cut and fill sections on all access roads should be revegetated with indigenous species or adapted species that match native plant community phenology. Planting should occur at the earliest suitable planting date. All post-construction debris should be removed immediately after construction.

4.9.6 Unavoidable Adverse Impacts

Significant impacts, as identified using the significance criteria, related to induced contrast in area, line, form, color, and texture due to project construction would be reduced by implementation of mitigation measures. However, even with the very best implementation of mitigation high, contrast would remain between disturbed areas (roads, helicopter staging area, and drill site) and surrounding undisturbed landscape. Dust control would effectively eliminate or reduce short-term impacts due to fugitive dust.

Where project construction would occur in areas delineated as Partial Retention and Retention, no practical mitigation could reduce or avoid this significant impact short of down grading the areas to Modification. Therefore, construction and operation of the proposed project or alternatives would result in unavoidable adverse impacts. The magnitude of these impacts would be the same as described under the detailed discussion on direct and indirect impacts presented above.

4.10 RECREATION

4.10.1 Introduction

Recreation impacts potentially associated with this type of project include the possible displacement of certain kinds of recreation activity as a result of project-related land use changes, road use, road development, or noise. Project activities may also result in a deterioration of recreation opportunities and qualities even when actual displacement of recreation users does not occur, and may lead to corresponding deterioration of the satisfaction which users derive from the recreation experiences available in the affected area.

4.10.2 Impact Significance Criteria

For the purposes of this analysis, impacts that would occur to recreation in the project area as a result of construction and operation of the proposed project or alternatives were considered significant if the following occurred:

- Alteration of the existing recreation use patterns or recreation opportunity characteristics in the affected area for more than one recreation season (or one year) occurred.
- Construction of project related facilities or roads within 200 feet on either side of the centerline of any and all designated trails within the lease area.
- Changes occurred in recreation opportunity that would violate the objectives of existing recreation opportunity spectrum (ROS) classifications (as defined in Appendix C-3).
- Sustained or recurring project-related noise occurred that would be audible to recreationists in primitive areas.
- Disruption or displacement of specific recreation groups or entities providing recreation services occurred which would exceed one year or one season of use.

More temporary effects involving short-term displacement or disruption of recreation activities or recreationists were generally not considered significant, unless they would involve very large numbers of recreationists or recreation providers and no nearby substitute or alternative areas for similar recreation use are available.

4.10.3 Direct and Indirect Impacts

4.10.3.1 Drill Site

Development of the drill site would likely result in significant impacts to recreation. The primitive nature of the recreation resource at and near the drill site would be altered during the period of construction and operation. The existing pack trail in the vicinity of the drill site could be obliterated by construction activities. This would alter recreation use of the trail which would be considered significant. The pad area and drill mast (rig) itself would be highly visible to recreationists using the area near the drill site as discussed in the existing Visual Resource section. In addition, noise generated by site preparation equipment and drilling activity would carry for a considerable but undetermined distance, creating an additional disturbance inconsistent with the Primitive ROS classification of the area surrounding the drill site.

4.10.3.2 Access Alternatives

4.10.3.2.1 Alternative A

Development of this access route would likely result in several significant recreation impacts. Construction of the access road up Kettle Creek and in to the upper portions of Sohare Creek would obliterate portions of the existing pack trail following the same alignment. This would result in an alteration of recreation use of the trail which would be considered significant.

The primitive nature of the recreation resource in the area of the drill site would be altered during the period of road development and drilling. In addition, noise generated by trucks would carry for a considerable but undetermined distance which is inconsistent with the Primitive ROS classification of the area surrounding the drill site. Approximately 18,542 acres would have to be reclassified from Primitive (P) to Semi-Primitive Non-Motorized (SPNM), 4,516 acres from P to Roaded Natural (RN), and 373 acres from SPNM to RN as a result of development of the drill site and Access Alternative A (see Exhibit 4-2).

In the event that the exploratory drilling activity resulted in an unproductive well, or otherwise in a decision not to proceed with production, this reclassification would need to be maintained for the entire 12-month exploratory period, as well as during the longer time frame required to complete reclamation and revegetation of the drill site area and new roads as discussed in the Vegetation, Timber, and Range Resources section. It is likely that the area could not be restored to the previous ROS classification for at least 5 years following final reclamation. Thus, these impacts would be significant, in the short term, even if the well did not go into production.

In the event that the exploratory activity was followed by a 20 to 30 year well operation period, the reclassification would need to be maintained for that entire period plus the additional period necessary for restoration to natural conditions.

Since the proposed first-year construction and exploratory drilling operations would run through an entire 12-month period, recreation activities during all seasons of use could potentially be affected. During the summer and fall months, dispersed recreationists using the areas along and adjacent to the proposed access route would be affected by road construction equipment and increased numbers of trucks and other vehicles traveling to and from the drill site. The impacts on recreation would be of limited significance if the development ended after the first exploratory phase, since disruption of these recreation activities would involve only one season and in many instances recreationists could temporarily relocate to other nearby areas.

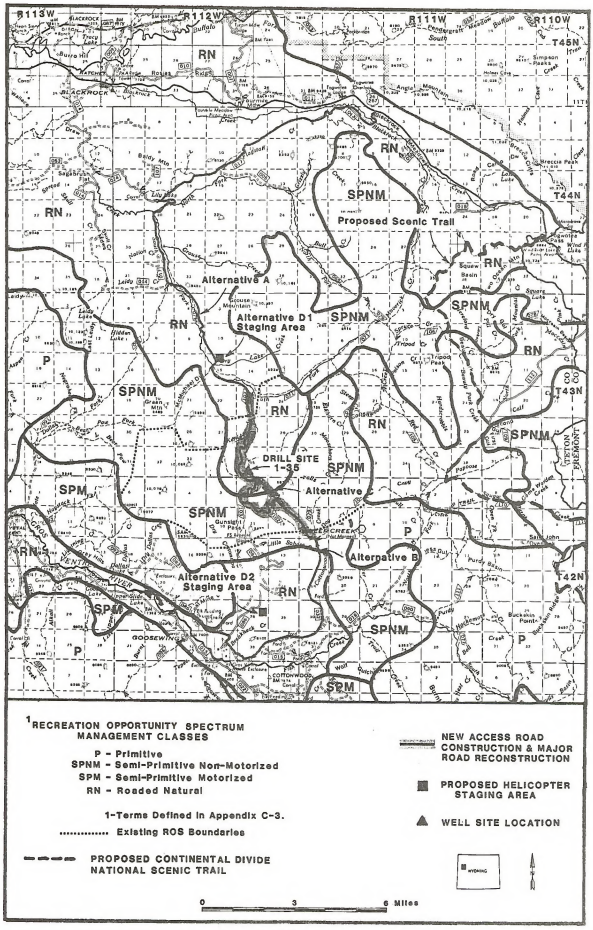


Exhibit 4-2.

CHANGES IN RECREATIONAL OPPORTUNITY SPECTRUM DELINEATIONS FOR ALTERNATIVE A.

However, there would be long-term significant impacts if the well was put into production and oil was regularly transported out of the area by truck for 20 to 30 years. Although current vehicle use on the existing roads in the area as described in the Transportation section suggests that recreation use would not be totally displaced by the presence of additional equipment and traffic, the recreation experiences of users who did not relocate would deteriorate, particularly among those whose activities are focused in areas that currently provide primitive, wilderness-type recreation opportunities. Horseback riding and wagon train activities in the area would also likely be seriously affected, since such activities generally require use of some of the same roads and trails that would be used for the access route.

Impacts on hunters and hunting outfitters could result from disturbance of big game, increased hunting pressure resulting from easier access into formerly roadless areas, and a deterioration of the primitive recreation experience which is important to many hunters. During the first-year development and drilling period, some hunters would likely be displaced at least temporarily. The one commercial outfitter whose camp is immediately adjacent to the Kettle Creek route would be negatively affected by road construction and by the inability to book or satisfy hunters who would object to a camp surrounded by construction equipment and truck traffic. That outfitter has reported that his operation was adversely affected by the earlier Exxon exploratory well due to increased hunting pressure in primitive areas which resulted when workers violated road closure regulations and provided hunters with transportation into and out of the area. In addition, this outfitter indicated that the Exxon well activities in the Kettle Creek drainage created dissatisfaction among many hunters, who complained about noise and the presence of roads in an area where they had expected to experience a wilderness setting (Merritt 1987).

Both this outfitter and the outfitter whose camp is on Cottonwood Creek would be at least partially displaced from their primary elk hunting areas in the Kettle Creek and Sohare Creek drainages due to project-related road development and noise . However, this displacement would be temporary if the well did not go into production. To some degree, hunters and outfitters would be able to shift their activities into nearby areas not immediately adjacent to the drill site or access routes, and thereby at least partially avoid direct exposure to project facilities and activities. Some might temporarily abandon hunting use of the affected area, but could return the following season. Consequently, the short-term impacts of exploratory development activities would create dissatisfaction and would disrupt some hunting recreation, but would not significantly alter the overall long-term hunting recreation patterns in the area.

The longer-term effects associated with a producing well would probably eliminate the commercial operation based on Kettle Creek, since there are few alternative locations in which a base camp can be located near productive and uncongested hunting areas. Long term adverse impacts would also affect other outfitters using this area, as well as non-guided hunters. Increased hunting pressure resulting from easier access via roads and possible alteration of big game distributions and behavior patterns could result in decreased hunter success, potential loss of business for outfitters permitted to use the area, displacement of hunters into other areas and consequent increased crowding in those areas, and dissatisfaction among those who have come to rely on the area to provide both substantial big game populations and a "primitive" recreational hunting experience. Overall, these effects suggest that long-term impacts on hunting recreation would be significant, although available data preclude a quantitative assessment.

Both exploratory development and well production would have adverse effects on snowmobiling, but would probably not cause extensive displacement of recreationists or a reduction in snowmobiling activity in the area. Use of the Flagstaff Creek and South Fork Roads for transporting equipment and personnel during the exploratory drilling period would create a short-term conflict with snowmobiling use, but the presence of nearby alternative snowmobiling routes and the fact that there already exist similar conflicts due to logging traffic on these roads suggest that such impacts would be minor and insignificant in the short term. However, longer-term closure of these roads to snowmobile use which would accompany a 20 to 30 year production period would have more serious impacts. Use of trails which parallel and cross these roads would result in a deterioration of the recreation experience and contribute to increased risks of snowmobile-truck collisions. In addition, as future levels of snowmobiling use continue to rise the level of demand for recreation access will increase the potential for conflicts between snowmobiling use of the area and well production activities.

In addition to the direct impacts discussed above, well development under Alternative A could also have a number of potentially significant indirect impacts in the long term. Displacement of recreationists from the area affected by Alternative A, particularly big game hunters and snowmobilers, would contribute to increased levels of use in surrounding areas. Since long-term trends point toward increasing demand for recreation access in this part of Wyoming, this displacement would contribute to crowding in other areas. Consequently, both persons displaced as a result of well and access road development and persons crowded by the relocation of displaced recreationists would experience a deterioration in the quality of their recreation experiences.

Another potentially significant long-term indirect impact would involve reduced satisfaction among recreationists who oppose the elimination of a roadless area of the National Forest which now provides opportunities for a primitive, essentially "wilderness" recreation experience. There are some members of the public who feel that ample roadless area exists in this region's designated wilderness areas and National Parks. However, the limited number of such areas and increased recreation demand for such opportunities suggests that the development of this project would be likely to elicit dissatisfaction among both actual and potential users of the area.

4.10.3.2.2 Alternative B

Recreation impacts under this alternative would be similar to those identified under Alternative A, but the magnitude of various effects would differ. The development of the drill site and this access alternative would necessitate the reclassification of 19,502 acres from current ROS classifications. Of that total, 4,320 acres would be reclassified from P to RN, 13,760 from P to SPNM, and 1,422 from SPNM to RN (see Exhibit 4-3). As discussed under Alternative A, restoration of these areas to their previous ROS classifications would require at least several years after all exploratory or production activities were terminated. Consequently, impacts on recreation opportunities in the affected area would be significant for both the one-year exploratory phase and the longer-term production scenario, but would be more severe in the long term.

As discussed under Alternative A, construction of this alternative would obliterate portions of existing pack trails using the same alignment as the proposed access route. The alteration of recreation use would be considered significant.

Impacts on developed site and dispersed recreation use along the Gros Ventre Road and the Cottonwood Creek Road would result primarily from increased traffic involving construction equipment, trucks carrying components and supplies for the access road and drill site development, and project personnel. Recreationists using campgrounds and picnic areas adjacent to the Gros Ventre Road could experience a deteriorated recreation experience and limited displacement as a result of road upgrading traffic increases, and related noise and dust. In addition to campground users, other affected user groups would include the limited numbers of recreationists who engage in dispersed camping, hiking, fishing, and ORV use on or near to the proposed access route. These impacts would be notable but generally not significant under a scenario involving only a one-year exploratory well development. However, continued traffic-related effects accompanying a 20 to 30 year well production period would cause long-term and significant changes in the type and quality of recreation opportunities available in this area, especially if

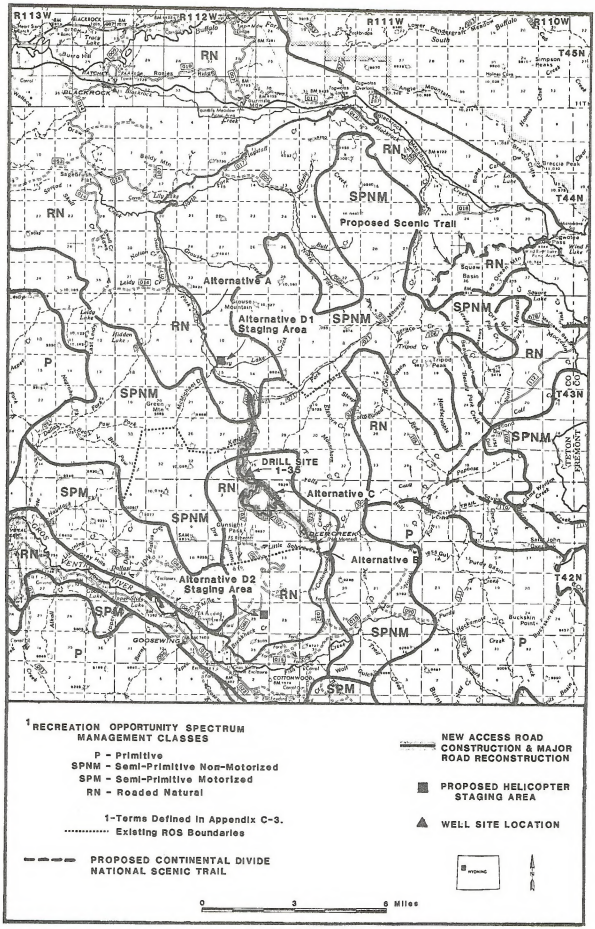


Exhibit 4-3.

CHANGES IN RECREATION OPPORTUNITY SPECTRUM DELINEATIONS FOR ALTERNATIVES B AND C.

current trends toward increased use and commercial recreation development of the area continue.

Impacts on both commercial hunting outfitters and non-guided hunters would be quite similar to those discussed under Alternative A. If development involved only a one-year exploration period, overall impacts on hunting recreation would be of limited significance. Most of the outfitters and individual hunters using the area would experience inconveniences and perhaps less successful and satisfying hunting as a result of road and well-site development. The outfitter who maintains his sole hunting camp at the confluence of Sohare, Little Sohare, and Cottonwood creeks would experience significant adverse effects, but would probably be able to survive a one-season disruption of his operation. However, the long-term effects associated with putting the well into production would probably force this individual out of business, due both to the development of the access route through the camp area and the potential disruption of hunting in his primary hunting territory, which is the Sohare drainage. Other outfitters and hunters who use the Sohare Creek and Kettle Creek drainages would be likely to experience less extreme but still significant negative impacts as a result of increased access into the area, possible declines in hunter success, and a deterioration of the primitive recreation experience associated with hunting in these areas.

Effects on snowmobiling would be more problematic than those identified under Alternative A. As noted in the Affected Environment section, the Gros Ventre Road receives heavy snowmobiling use by both individual recreationists and commercial operators. Winter use of the Gros Ventre Road for drill site access would require plowing the entire distance to Cottonwood Creek. This would result in serious problems as a result of the conflict between motor vehicles (both well development and other traffic) and snowmobiles using the road. During the winter of 1986-87 a section of this road was plowed, due in part to abnormally low snowfalls. In general motor vehicle use has been low, and to date no serious accidents have occurred. However, local FS personnel report that there have been several "close calls", and also note that an existing law prohibits snowmobiling on roads open to motor vehicles, although that law is currently not being enforced in the area (Mourtsen 1987). Increased traffic associated with well exploration and possible production would generate far more serious conflicts, due to the increased distance plowed, the narrow and curving nature of the roadway, and the presence of steep embankments which in several sections prevent the establishment of snowmobile trails adjacent to the roadbed.

Since there are no practical alternative routes in this section of the Forest, closure of the road to snowmobile use would have serious adverse effects on recreationists and commercial snow-

mobiling and lodge operations even if only one season was disrupted by exploratory drilling activities. Longer term closure which might result from oil production would essentially eliminate snowmobiling use in the area and would likely force the commercial operators out of business. Thus, there would be significant short-term and long-term effects on snowmobiling recreation under this alternative.

Indirect impacts would be similar to those discussed under Alternative A, but would probably be more severe. Alternative B would involve more new roads in a roadless area with wilderness qualities, contributing to dissatisfaction. This alternative also has the potential to cause far greater levels of snowmobiling displacement, which could create more severe crowding in other areas than would be expected under Alternative A.

4.10.3.2.3 Alternative C

Recreation impacts under this alternative would for the most part be identical to those discussed under Alternative B (see Exhibit 4-3). Impacts associated with access route development and use along the Gros Ventre and Cottonwood Creek Roads would be the same for both alternatives. Since this alternative would place a part of the access route immediately adjacent to Sohare Creek at the bottom of the drainage, visual impacts on recreationists using the area might be somewhat lower than would be the case if the road was routed along the wooded slopes as specified under Alternative B. However, very few recreationists other than big game hunters frequent the area near this segment of the access route, and the other, more significant direct impacts of access route and drill site developments on snowmobilers and hunters would be identical to those which would occur under Alternative B.

Indirect impacts associated with this alternative would be identical to those discussed under Alternative B.

4.10.3.2.4 Alternative D

Northern Staging Area (D1). The location of the helicopter staging area would seriously disrupt the activities of the outfitter whose camp is located on Kettle Creek in the short term. Effects on hunters and outfitters using the Kettle Creek and Sohare Creek drainages would include noise from drill site activities and helicopters using the area, which would contribute to a deterioration of the primitive, wilderness hunting experience that is presently available in this area and which contributes to the quality dimensions of hunting experiences. In primitive settings such as the affected area, recreationists are likely to be disturbed by any audible noise that is perceived as inconsistent with an environment that they expect to be unmodi-

fied by human activity. However, since this disturbance would affect only one season, the impacts on overall hunting recreation activity in the area would be not be significant.

Assuming that helicopter flights from this staging area to the drill site would generally follow the shortest linear route, the combined presence of the drill site activities and relatively low-level helicopter fly-overs in the area now designated as Primitive under the ROS classification system would require that an area similar to that identified under Alternative A be temporarily reclassified as Semi-Primitive Motorized.

Southern Staging Area (D2). Short-term impacts would result to the hunting outfitter whose camp is located on Cottonwood Creek due to the location of the staging area about 2 miles west of that camp, including noise from drill site activities and helicopters, which would be inconsistent with the primitive recreation experience which many hunters prefer. These effects would be of limited overall significance, since they would involve disturbances during only one hunting season.

Assuming that helicopter flights from this staging area would follow the shortest linear route to the drill site, a temporary reclassification of ROS areas now classified as Primitive to SemiPrimitive Motorized involving an area similar to that discussed under Alternative B would be necessary.

4.10.3.3 Impacts Summary

The analysis presented above indicates that the development of the Sohare Creek exploratory oil well could result in a number of short and long-term adverse impacts on recreation opportunities and activities in the affected areas. Significant adverse impacts would be expected under all of the alternatives.

In evaluating the differential impacts which could result from Alternatives A through D, the analysis presented in this report suggests that the alternatives which propose a northern access route (A and D1) would cause fewer and less severe short- and long-term recreation impacts than would any of the alternatives (B, C, and D2) involving a southern access route to the drill site. The reasons for this difference involve primarily the relatively greater disturbance of snowmobiling use which would occur if the southern access route was selected. In addition, the southern access route would require more new road development in currently roadless areas than would occur under the northern access alternatives. Impacts on hunters and hunting outfitters would be very similar with either northern or southern access routes. Noise associated with helicopter access (Alternatives D1 and D2) would potentially disturb hunters over a wider area than would be the case with the road access alternative. However,

these impacts would be of limited overall significance, since, they would involve disturbances during only one hunting season.

4.10.4 Cumulative Impacts

Information available about other ongoing and planned projects suggests that development of the Sohare Creek drill site could interact with other developments in the area in a manner that could significantly alter the recreational opportunities and characteristics of the affected area. There has been active timber cutting operation in the vicinity of the Kettle Creek access route which has already adversely affected recreation conditions and activities in that segment of the National Forest. However, this timber harvet activity is scheduled to terminate in 1987. Nevertheless, the additional intrusion of the drill site access route under Alternative A could result in cumulative effects that would cause a further deterioration of recreation conditions.

In addition, the development of new and improved roads into this area could stimulate additional logging activity in areas which are presently not readily accessible or which have not yet been approved for timber leases. For example, the Gunsight Pass area has been reviewed for timber sales, and would become more readily accessible if the southern access route (Alternatives B and C) to the drill site was developed. The cumulative effects generated by additional logging in the area would adversely affect hunting, snowmobiling, and other dispersed recreation activities in the affected areas. However, this timber harvest activity is scheduled to terminate in 1987.

4.10.5 Mitigation Summary

Recreation impacts that would occur as a result of construction and operation of the proposed project or alternatives could be reduced through the application of a variety of mitigation procedures. Moratorium periods that would stop construction activities and longer-term oil shipments and well operation activities during big game hunting seasons would reduce adverse impacts on hunting outfitters and hunters, as would strict enforcement of road closure requirements to prevent non-authorized use of the access roads. Possible displacement of hunting outfitters in the long-term could be partially mitigated by the provision of support for relocation of the affected outfitters' camps or through other compensation. Impacts that would occur to recreation use of pack trails affected by the project could be reduced by relocating trails away from the areas of disturbance. Adverse effects on snowmobiling recreation could be partially mitigated through the development of safety programs to reduce the potential for accidents involving snowmobilers and project vehicles, limiting periods of project vehicle use of access roads, and development of alternate snowmobile routes.

4.10.6 Unavoidable Adverse Impacts

Implementation of the mitigation procedures summarized above and discussed in greater detail in the Mitigation Chapter would substantially reduce the level and severity of adverse impacts on the recreation opportunities and activities of the project area, but would not eliminate all significant adverse impacts. In both the short term and long term, project-related effects would be in violation of current ROS classification, necessitating the reclassification of large areas of the forest into less primitive recreation opportunity categories. In addition, there would still be significant unavoidable adverse impacts on dispersed recreation activities, especially involving big game hunting.

Impacts involving the degradation of a primitive recreation setting and reduced opportunities for both actual and potential recreationists to attain satisfaction from experiencing a wilderness-type recreation experience could not be mitigated. Similarly, long term impacts on the "quality" elements, which attract hunters and other recreationists to the affected area, could not be fully resolved. Traffic and recreational vehicles and activities on or adjacent to access routes would not be fully resolved by the mitigation procedures identified above. Consequently, significant short-term and long-term adverse impacts on recreation opportunities and activities would remain even if all of the mitigation procedures summarized above were implemented.

4.11 SOCIOECONOMICS

4.11.1 Introduction

A number of social changes could result from the various access alternatives and well site development. A project of this type is extremely unlikely to cause any extensive social disruptions of the type experienced in a number of contemporary 'boom towns', due to the limited scale of the project and the small work force that would be required. However, projects of this type may in some instances force a limited displacement or redistribution of existing residential populations, due to an incompatibility between project activities and either residential land uses or existing employment and income-generating activities. More subtle possible impacts include changes in established social structures, cultural patterns, and traditional lifestyles that may have developed over extended periods of time in and around the affected area. Such changes could occur as a result of project-induced shifts in occupational patterns of local residents, or as a result of conflicts involving individuals and organizations that may express opposing viewpoints and preferences about the project.

The economic impacts of the proposed Sohare Creek well project and the alternative access routes are dependent on the productivity of the well. If the well is unproductive, it would presumably be capped after the exploration stage and the access road reclaimed. If the well is productive, it would require that the access road be maintained for the 20 to 30 year anticipated life of the well so that oil could be trucked from the site on a regular basis. Since the impacts on the area are markedly different for these two scenarios, the economic impacts must be analyzed separately.

Because of the localized nature and small size of this project, no distinction is made between direct and indirect impacts. Any division of the economic effects into direct and indirect categories would necessarily be arbitrary and detract from the fundamental goal of this discussion.

4.11.2 Impact Significance Criteria

Social Conditions:

Impacts to social conditions would be considered significant if they involved the following:

- Any permanent displacement of residents or users of the affected area.
- Identifiable changes in or conflicts with existing ways of life.
- Levels of dissatisfaction likely to generate organizational response and conflict within the surrounding human community.

Economic:

The total economic impacts for the proposed well can be disaggregated into separate impacts associated with individual resources. Impacts were defined as significant if they involved:

- A change in revenue flows within the local economy.

4.11.3 Direct and Indirect Impacts

4.11.3.1 Drill Site

For purposes of analysis of socioeconomic impacts, the drill site was considered in conjunction with each of the various access alternatives.

4.11.3.2 Access Alternatives

4.11.3.2.1 Alternative A

4.11.3.2.1.1 Social Conditions

The development of the drill site and access route described under this alternative would have very limited direct effects on social conditions in the affected area. Only 30 drilling personnel would be required. It is likely that most of these workers would temporarily relocate from communities throughout the region. The small number of workers and the plan to provide temporary housing facilities at the drill site would prevent any significant increase in demand for housing or other services in area towns.

One of the primary forms of potentially significant social impact that could result from development under this alternative involves changes in the lifestyles of recreationists and outfitters who frequent the impact area and who could be partially or totally displaced from using the area. However, it is unlikely that social conditions would be altered as a result of a one-year exploratory drilling program. Both short and long-term direct effects would also be limited due to the absence of an established local population base near to the northern access route or drill site. Nevertheless, development of a producing well would likely displace one or two hunting outfitters and reduce opportunities of others who frequent the area, thereby significantly altering the social well-being of a relatively small number of area residents.

Persons who engage in private or commercial recreation uses of the affected area are likely to experience dissatisfaction as a result of reduced and altered recreation opportunities available in the affected area (see Recreation Section). In addition, implementation of this alternative would probably also result in general dissatisfaction among that segment of the area population which opposes resource development in this section of the National Forest. As noted previously, many residents as well as organizations in the Jackson Hole area have expressed opposition to resource developments which are perceived to threaten the quality and attractiveness of the natural environment of the area. In particular, there appears to be substantial opposition to projects which would involve development within roadless or primitive areas which provide for wilderness-type recreation opportunities or which are sensitive in terms of visual or ecological conditions. Consequently, the development proposed under Alternative A could elicit opposition and controversy in the area. These would represent significant, although non-quantifiable, indirect impacts of the project.

4.11.3.2.1.2 Economics

Outfitted Elk Hunting: Although a number of outfitters hunt in the affected area, only one would be directly impacted. The other outfitters hunt the area infrequently and could adjust to Alternative A by altering their hunting pattern marginally.

The outfitter that would be significantly impacted has his main camp in the Kettle Creek Drainage. If the Sohare Creek well is dry, it is possible that the outfitter's camp could be relocated to an adjacent area for the 12-month exploration period without significant economic impact. This conclusion is based on two factors: the identification by FS personnel of an area immediately to the east of Kettle Creek that would support additional outfitter use (Childress 1987) and the Proposed Bridger-Teton Forest Plan, which shows that there is currently not a severe shortage of elk hunting capacity in Wyoming (Chart II-17, p II-48). Thus it is reasonable to conclude that an exploratory well that did not go into production would produce negligible economic impacts on elk outfitters.

If the well becomes productive, however, it would have an impact for 20 to 30 years, during which time demand for elk hunting is projected to grow much faster than capacity. If the number of elk permits does not regulate hunter capacity, this implies that demand in 20 years could reach a point where there would be no under-utilized areas. Also, there would be an outfitter operating in the area if the well didi not exist. It therefore seems reasonable to conclude that the long run economic effect would be the elimination of one outfitting operation. The current annual receipt of the Kettle Creek operation for a typical year is estimated to be the following:

		Capitalized Value	
	$/year	4%	7.125%
Revenues*	30,000	468,663	345,706

Source: Merritt, personal communication
*assumes 15 hunters/year

The capitalized value is the present value of the annual receipt and benefit flows over 25 years. The discount rates of 4 percent and 7.125 percent are chosen to be consistent with the Bridger-Teton planning process.

Non-outfitted Elk Hunting: The non-outfitted use of this area is currently minimal. There is reason to believe that Alternative A could increase day use in the area, because the road would improve access. Conversely, the drilling operation and truck traffic could decrease the quality of the hunting in the area. This could also be interpreted as a beneficial impact. The added

road would open additional areas to non-outfitted hunters, thereby relieving excessive hunter capacity in other units. The total effect, however, is ambiguous, and there is insufficient information to quantify it.

Snowmobiling: The impact of Alternative A on snowmobile use would occur primarily because of the plowing of the Flagstaff Road to the north. Three use groups would be impacted: the operators of Togwotee Lodge, day guides, and local residents. As with elk hunting, the economic impacts are contingent on the length of the drilling operation. If the project is only one year, the economic impacts would be minimal. If the well is productive, the Flagstaff Road must be plowed for oil trucks indefinitely. The manager of Togwotee Lodge estimates that while 50 percent of his guests use the Flagstaff Road area there are substitutes for the Flagstaff Road; thus a 20 percent reduction in revenues for the Togwotee Lodge in the long run is appropriate. Since the Lodge generates a gross revenue of $300,000, a 20 percent reduction in visitation equals a $60,000 annual revenue loss, which has a present value of $692,141 at 7.125 percent and $937,325 at 4 percent for a 25-year stream (Helgeson 1987). No data is available for the economic impacts to either day use outfitters or local residents. The impact is assumed to be negligible because both of these user groups could more easily re-locate to other areas.

Summer Use: The summer use in the area comes from two sources: dispersed use and commercial trail ride operation (primarily Wagons West). The economic impacts to the dispersed users in both the short and long run, as well as to the trail ride operation in the short run, would be minimal. The long run effects on the trail ride operation could be substantial, but no data is available at this time.

Timber: Alternative A could increase the net present value of timber sales in the Kettle Creek drainage because the presence of the road would significantly reduce the cost of initial entry. Data are not yet available to quantify this impact.

Aggregate Local Economy: Alternative A would increase employment and income to Jackson and neighboring towns. The expected cost of constructing and reclaiming the Kettle Creek Road is $513,690 and drill site construction and reclamation is $153,600. The aggregate impact is therefore $667,290, only a portion of which would remain in the Jackson area. This alternative has the potential for positively impacting the Dubois area economy. Data is not yet available to quantify this value with precision, but assuming that 50 percent of the revenue remains in the area, the positive economic effect is approximately $333,645.

The wages of the drilling crew would also positively impact the area economy. The estimated days work rate of $9,000 per day

(Wingerter 1987) and a drilling duration of 180 days yields a wage bill of $1,620,000. Assuming that 20 percent of their wages remain in the area, the positive economic effect on the area is $324,000.

In addition, substantial tax revenues would be generated for both Wyoming and Teton County. The exact level of tax revenue depends on the productivity of the well and the price of oil, two factors that are currently unknown. Even though it is impossible to precisely project expected tax revenue, historic data regarding well productivity provides some general insight.

There are 64 producing oil units in the seven-county area of western Wyoming (Teton, Hot Springs, Lincoln, Park, Fremont, Sublette, and Uinta counties), with an average of 6.54 operating wells per unit (Robitaille 1986). Converting data provided by industry on these units to a per-well basis yields the tax revenue figures in Table 4-7. These figures are the best currently available, but nevertheless should be viewed as only general estimates of projected tax receipts.

4.11.3.2.2 Alternative B

4.11.3.2.2.1 Social Conditions

Implementation of Alternative B could cause significant adverse impacts on the lifestyles of those individuals who reside in immediate proximity to the access route, along the upper sections of the Gros Ventre Road. The disruption of recreation-based commercial activities would negatively affect the well-being of some of these local residents. Increased traffic levels and a decline in the solitude of the area would conflict with the traditional ranching activities and lifestyles maintained by others. Although these effects would not be significant in the event of a one-year exploratory operation, the long-term effects of a 20- to 30-year production period would likely cause significant life-style changes affecting those living in this localized area. Further, the potential for such impacts is likely to increase in future years as a result of probable increases in both year-around and seasonal residential development in this area.

Implementation of Alternative B would result in the same kinds of indirect social impacts identified under Alternative A. Satisfaction levels among recreationists and outfitters who use and value the area surrounding the drill site and access route would be negatively affected. General dissatisfaction among the area public would be likely.

Table 4-7. Estimated Tax Implications of Production Well.

Estimated Per-Well Tax Receipts		
Annual production (BOE)		$163,117
Price per BOE		28
Annual production value		4,567,273
Tax Revenues, annual[1]		
State severance		274,036
State share, Federal royalties		285,454
Total State	559,490.00	
Teton County, property tax		298,700
Capitalized Value of Tax Revenues[2]		
	4%	7.125%
State	8,720,398	6,447,296
County	4,666,309	3,442,042

[1]Omits federal share of royalties
[2]Assumes 25-year revenue stream

4.11.3.2.2.2 Economics

Outfitted Elk Hunting: As with Alternative A, one outfitting operation would be directly impacted by this access route.

The impact to this outfitter would be minimal if the well does not go into production, since the outfitter could temporarily relocate. If the well is productive, the more reasonable conclusion is that the outfitter would be forced out of business. This outfitter typically guides 20 hunters per year at $2,000 per hunter. Repeating the analysis from Alternative A yields the following economic impacts:

		Capitalized Value	
	$/year	4%	7.125%
Revenue	40,000	624,884	460,941

Non-outfitted Elk Hunting. As with Alternative A, the access road has the potential of increasing day use in the area, but also decreasing the quality of that use in the Sohare area, but perhaps increasing it elsewhere. The overall effect is therefore

ambiguous and the data needed to quantify the effect is unavailable.

Snowmobiling: The impacts of Alternative B fall on four constituencies: the operators of Goose Wing Lodge, snowmobile guides, unguided recreationists, and local residents who snowmobile in the area. The impacts on these groups would be significant whether the well remains exploratory or not. The impact is due not to the well itself, but due to the loss of the Gros Ventre Road as a snowmobiling resource. Moreover, the impact is increased because there is no substitute for the Gros Ventre Road, if trying to get to the Goose Wing Lodge from the west.

The Goose Wing Lodge anually generates approximately 1,000 overnight users at $60 per night, and 3,000 visits for a meal, at an average of $7 per meal (Clark 1987). This is a total revenue of $81,000, which has a capitalized value of $933,405 at 7.125 percent, and $1,265,390 at 4 percent, over 25 years. In addition, 1,000 of the day users per season are being brought in by commercial guides, at an average rate of $60/day (Goetz 1987). Assuming that the commercial guides are only able to relocate 75 percent of this use to other areas, there is a potential revenue loss of $15,000 per season, which over 25 years has a present value of $172,853 at 7.125 percent and $234,331 at 4 percent. There is also significant negative economic impact to local users that could be estimated through willingness to pay calculations. The data for such calculations is not available.

Summer Use: The economic impacts to summer users of the area appear to be minimal, and at this point are unquantifiable.

Timber: Alternative B could increase the net present value of timber harvesting in the Sohare Creek drainage because the cost of initial entry would be significantly reduced. Data are not yet available to quantify the impact.

Aggregate Local Economy: Alternative B would increase employment and income in the Jackson area. The expected cost of constructing and reclaiming the Sohare Creek Road is $1,937,440 and the cost of constructing and rehabilitating the well-site is $153,600 for a total of $2,091,040. If 50 percent of this cost remains in the area, the positive economic effect would be approximately $1,045,520.

The economic impact of the drilling operation would be the same as under Alternative A, producing a positive impact of $648,000.

In addition, substantial tax revenues would be generated for both Wyoming and Teton County. The exact level of tax revenue depend on the productivity of the well and the price of oil, tow factors

that are currently unknown. Even though it is impossible to precisely project expected tax revenue, historic data regarding well productivity provides some general insight.

There are 64 producing oil units in a seven county area of western Wyoming (Teton, Hot Springs, Lincoln, Park, Fremont, Sublette, and Uinta counties), with an average of 6.54 operating wells per unit (Robitaille 1986). Converting data provided by industry on these units to a per-well basis yields the tax revenue figures in Table 4-7. These figures are the best currently available, but nevertheless should be viewed as only general estimates of projected tax receipts.

4.11.3.2.3 Alternative C

4.11.3.2.3.1 Social Conditions

With respect to impacts on social conditions, the impacts associated with this alternative would be identical to those discussed under Alternative B.

4.11.3.2.3.2 Economics

Alternative C would produce the same economic impacts as would Alternative B, with the following exceptions:

Timber: The modified route accesses different stands of timber implying a change in potential present net value of harvesting.

Aggregate Local Economy: The modified route costs $1,670,810 to build and then obliterate. Using the same economic assumptions as with Alternatives A and B, the economic impact is $1,236,205.

4.11.3.2.4 Alternative D

4.11.3.2.4.1 Social Conditions

Social impacts associated with the northern helicopter access staging area near Kettle Creek (subalternative D1) would be indistinguishable from those discussed under Alternative A. Social effects of helicopter access using the southern staging area (subalternative D2) would be indistinguishable from those under Alternative B.

4.11.3.2.4.2 Economics

The economic impacts of Alternative D are contingent upon the choice of staging area for the helicopter. If the northern staging area is chosen, the impacts would be approximately equal to Alternative A; if the southern staging area is chosen, the impacts would be approximately equal to Alternative B. The exceptions are discussed below.

Non-outfitted Elk Hunting: Regardless of the helicopter route, the impact on non-guided elk hunting is unambiguously negative in the exploratory stage, because the hunters lose the potential benefit of improved road access in the area but incur the adverse impact of helicopter noise.

Timber: Under this alternative, the road to the drill site would not be built. The possible increase in present net value of timber harvesting would therefore be foregone.

Aggregate Local Economy: The receipts from the helicopter operation would not stay in the local economy to the same degree as road building expenses, because the crew and equipment would need to be imported from other areas.

The economics of helicopter access for an exploratory well is shown in Table 4-8.

4.11.3.3 Impacts Summary

4.11.3.3.1 Social Conditions

Among the several action alternatives, the northern access routes (Alternatives A and D1) would be preferred over any of the southern access alternatives (Alternatives B, C, or D2). This conclusion is based on the observation that the northern access alternatives would not cause significant direct impacts on any established localized populations, whereas the southern access alternatives would directly affect the lifestyles and social well-being of the small number of seasonal and permanent residents who live along the Gros Ventre Road. Since both road access and helicopter access would generate similarly increased road use and plowing of roads in areas of limited residential land use and substantial recreation use, the social effects of Alternative D1 and D2 would be indistinguishable from Alternatives A, B, or C, respectively. Indirect social impacts associated with the northern and southern access alternatives are indistinguishable across the several access alternatives.

4.11.3.3.2 Economics

The aggregate economic impacts are shown in Tables 4-9, 4-10, and 4-11. There are two broad types of conclusions that can be derived from these tables. First, if a rigorous and precise cost benefit analysis is deemed necessary, additional data would be needed.

Many impacts are currently unquantified, and those impacts that are quantified have potential for bias.

Table 4-8. Economic Impact of Helicopter Access, Assuming Exploratory Well.

Alternative	Estimated Cost	% Remaining in Local Economy	Economic Impact
Northern Staging Area (D1)			
Helicopter	$1,769,500	15	$265,425
Staging Area	54,500	50	27,250
Road Improvement	116,610	50	58,305
Drill Site Construction and Reclamation	388,000	20	77,600
Drilling Crew Wages	1,620,000	20	324,000
TOTAL	**$3,948,610**		**$1,752,580**
Southern Staging Area (D2)			
Helicopter	$1,769,500	15	$265,425
Staging Area	54,500	50	27,250
Gros Ventre Road Improvement	998,110	50	499,055
Drill Site Construction and Reclamation	388,000	20	77,600
Drilling Crew Wages	1,620,000	20	324,000
TOTAL	**$4,830,110**		**$1,193,330**

Table 4-9. Economic Impacts of Exploratory Well in Sohare Creek

	Alternatives				
	A	B	C	D1	D2
Elk Hunting	-	-	-	-	-
Non-guided Elk Hunting	$\pm$	$\pm$	$\pm$	-	-
Snowmobile	-$60,000	-$96,000	-$96,000	-$60,000	-$96,000
Summer Use	-	0	0	-	0
Timber	0	+	+	0	0
Aggregate Economy	657,645	1,369,520	1,236,203	1,752,580	1,193,330

Symbols:
0 No effect, as yet unquantified
- Negative effect, as yet unquantified
$\pm$ Ambiguous effect, as yet unquantified
+ Positive effect, as yet unquantified
D1 Northern staging area
D2 Southern staging area

Table 4-10. Economic Impacts of Producing Well in Sohare Creek, 4% discount rate, 25-year analysis period.

	Alternatives				
	A	B	C	D1	D2
Guided Elk Hunting	-$468,663	-$624,884	-$624,884	NA[1]	NA
Non-guided Elk Hunting	±	±	±	NA	NA
Snowmobile	-937,325	-1,499,721	-1,499,721	NA	NA
Summer Use	-	-	-	NA	NA
Timber	+	+	+	NA	NA
Aggregate Economy	657,645	1,369,520	1,236,205	NA	NA
Tax Receipts[2]	13,406,707	13,406,707	13,406,707	NA	NA

[1]No production under the helicopter access is being considered at this time.

[2]Tax receipts include County and State recepts.

Symbols:
- O No effect, as yet unquantified
- - Negative effect, as yet unquantified
- ± Ambiguous effect, as yet unquantified
- + Positive effect, as yet unquantified
- D1 Spread Creek staging area
- D2 Hurricane Flat staging area

Table 4-11. Economic Impacts of Producing Well in Sohare Creek, 7.125% discount rate, 25 year analysis period.

	Alternatives				
	A	B	C	D1	D2
Guided Elk Hunting	-$345,706	-$460,941	-$460,941	NA[1]	NA
Non-guided Elk Hunting	±	±	±	NA	NA
Snowmobile	-691,411	-1,106,258	-1,106,258	NA	NA
Summer Use	-	-	-	NA	NA
Timber	+	+	+	NA	NA
Aggregate Economy	1,657,645	1,369,520	1,236,203	NA	NA
Tax Receipts[2]	9,889,368	9,889,368	9,889,368	NA	NA

[1]No production under the helicopter access is being considered at this time.

[2]Tax recipts include County and State receipts.

Symbols:
- O No effect, as yet unquantified
- - Negative effect, as yet unquantified
- ± Ambiguous effect, as yet unquantified
- + Positive effect, as yet unquantified
- D1 Spread Creek staging area
- D2 Hurricane Flat staging area

Second, even though many benefits are unquantified at this point, it is possible to make some general statements about the relative rankings of the alternatives. As might be expected, the negative impacts are much less for the exploratory than for the productive well. This is true for both elk hunting and snowmobiling, which are the two activities that appear to be most significantly impacted by either development scenario.

Alternative A has the least negative economic impact in both the exploration and production scenarios. This is because the outfitting camp affected by the southern route (Alternatives B, C, and D1) is larger than the one affected by the northern route (Alternatives A and D2). Moreover, the negative snowmobile impacts are more severe on the southern routes than on the northern route because the operations that are dependent on the southern route have fewer options regarding substitute areas.

From a strictly economic perspective, comparing preferable economic impacts simplifies to comparing the drilling alternative with the highest present net value with the no drilling alternative which has a present net value of zero. Given the available data, the preferable drilling alternative appears to be Alternative A. The preferred means of transportation is by helicopter if the probability of a productive well is low, but a road is preferred if the well is likely to go into production. In the exploratory phase, the Kettle Creek route provides significant local economic benefits, which are offset to some degree by negative impacts that are currently unquantified, but are unlikely to be larger than the benefits. If the well goes into production, the local economic benefits are increased by the tax receipts generated by the well, but the negative impacts also increase, but by a lesser amount. One qualification to these results is that the economic losses probably exceed the values listed in Tables 4-9, 4-10, and 4-11, which are merely revenue figures, and therefore omit the consumers' surplus, which could equal or exceed the revenues, implying that the negative impacts in Tables 4-9, 4-10, and 4-11 are understated. This would support the following conclusions:

1) An exploratory well in Sohare Creek is likely to have a present net value that is significantly positive.

2) A production well in Sohare Creek is likely to have a positive present net value, largely because of tax receipts. If the tax receipts are omitted, the present net value is at best zero and may be substantially below zero.

4.11.4 Cumulative Impacts

Social conditions in the Jackson area suggest that the direct effects of the Sohare oil well project would not cause a critical

shift in well-established developmental patterns, which in recent decades have eroded the foundations of the traditional ranching culture of the area. Similarly, the magnitude of direct effects associated with this project is not sufficient to alter the overall importance of recreation and tourism as the social as well as economic lifeblood of the greater Jackson area. However, localized effects on social conditions among the limited population immediately adjacent to the Gros Ventre Road might be exacerbated if a southern access route was selected for this project and other potential developments such as timber sales or additional oil and gas developments were to result in increased traffic and recreation conflicts in that area.

In contrast, the indirect cumulative effects of this proposed project and other current and anticipated projects could elicit opposition and controversy in the area.

4.11.5 Mitigation Summary

The following measures should substantially reduce the negative socioeconomic impacts and/or enhance positive impacts:

- Prohibit construction during hunting season.
- Use local contractors or laborers to the extent practical.
- Require compensation of dislocated outfitting or snowmobiling operations.
- Require construction of alternate snowmobile and pack trails.

4.11.6 Unavoidable Adverse Impacts

Implementation of mitigation measures summarized above would reduce the level of socioeconomic impacts. However, indirect impacts to the lifestyles of small populations as well as public conflict and controversy due to project implementation would still occur.

4.12 CULTURAL RESOURCES

4.12.1 Introduction

As applied to cultural resource management, the term significance has a specific legal meaning. Sites are evaluated based upon their eligibility for the National Register of Historic Places. Legislation has created a screening process that provides for protection of only the most significant sites. Protection for sites can only be assured if the sites meet eligibility require-

ments for the National Register (36 CFR 60.4), which define four categories of significance.

Eligibility is based on whether or not "The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- That are associated with events that have made a significant contribution to the broad patterns of our history; or
- That are associated with the lives of persons significant in our past; or
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- That have yielded, or may be likely to yield, information important in prehistory or history."

Specific criteria are lacking and, although there may be variations between states and between government agencies, there are certain general guidelines that seem to apply. Sites are generally not eligible if they lack diagnostic artifacts, subsurface remains or structural features. Sites that cannot be placed in a temporal context or related to other sites are usually not eligible and, therefore, cannot officially be protected. Much of the National Forest land has not been adequately surveyed and sites lacking the criteria of context may eventually be found to be important if related to other sites that have not yet been discovered. Any archeological resource discovered on National Forest lands has an unknown significance if it is discovered in an area where little previous survey has been performed. Sites should be considered potentially eligible unless evidence to the contrary is overwhelming.

4.12.2 Impact Significance Criteria

The Advisory Council on Historic Preservation (ACHP) has developed guidelines for determining adverse impact for any site on or eligible for nomination to the National Register of Historic Places.

Adverse impacts consist of:

- o Destruction or alteration of all or part of a property.
- o Isolation from or alteration of its surrounding environment.
- o Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.

These adverse impacts can be in the form of direct, indirect or cumulative impacts. Direct impacts are physical and adversely effect the site or its setting. Construction activities would be the primary direct impact to sites or structures on National Forest land. Indirect impacts would not immediately result in physical alteration of the site or its setting. A new access road into an area containing significant sites or structures would allow public access and exposure of the properties. Eventual artifact collection or similar activities would physically alter the site. If such activities were sporadic, their impacts over a period of time would be cumulative. Gauging the effect of any impact depends on the level of information available from the inventory. In the case of the Sohare Creek Unit only one archeological site has been recorded and its significance is unknown. Additional inventory may be produced from Class III walkover surveys.

4.12.3 Direct and Indirect Impacts

No sites or structures on or eligible for the National Register of Historic Places have been reported for the project area. It would be necessary to perform a Class III cultural resource inventory for the proposed undertaking to determine whether cultural resources exist in the project area and whether they would be affected by the proposed undertaking.

4.12.4 Cumulative Impacts

No determination can be made until a Class III inventory is completed.

4.12.5 Mitigation Summary

Impacts to cultural resources would be mitigated following procedures developed by the ACHP as specified in 36 CFR 800. This would require:

- o An intensive survey of the construction area and selected access road;

- An evaluation of identified resources for eligibility for the National Register of Historic Places, in consultation with the State Historic Preservation Officer;

- Determinations of effect on eligible properties in consultation with the ACHP; and

- Implementation of prudent and feasible measures to avoid or reduce adverse impacts.

4.12.6 Unavoidable Adverse Impacts

No determination can be made until a Class III inventory is completed.

4.13 HEALTH AND SAFETY

4.13.1 Introduction

Potential risks associated with implementation of the proposed project include the following:

- A very low risk of exposure to a hydrogen sulfide concentration due to an equipment failure or disaster during drilling or completion operations that could cause discomfort and possibly be lethal.

- The normal risks associated with traffic, heavy construction, and drilling operations.

- The risks of winter project traffic on historic and designated snowmachine trails.

- The risks associated with helicopter operations.

4.13.2 Impact Significance Criteria

The impact significance criteria relative to health and safety aspects of the drilling proposal is as follows:

- Exposure to hydrogen sulfide concentration that would cause discomfort and that might be lethal to certain sensitive individuals, e.g., to the very old, very young, or infirm. Concentrations at levels that would cause eye irritation, loss of smell, and possible coughing. Exposure to an instantaneous concentration of 1,000 parts/million (almost always lethal to humans).

- Increased risk to the public caused by project implementation.

4.13.3 Direct and Indirect Impacts

4.13.3.1 Drill Site

Impacts associated with the drill site and resident camp site would be those that are normally associated with heavy construc tion and industry. Hazards would be limited to Amoco employees and subcontractors, and would not affect the public.

The remote possibility exists of an accidental release of hydrogen sulfide (sour gas) due to equipment failure or natural disaster. Based on other exploratory wells drilled within Teton County in the same formations outlined in the Amoco drilling program for this well, the probability of encountering hydrogen sulfide is negligible. This would only be released if a "blowout" occurred. Industry-wide or state-wide figures are not available as to the probability of an accidental release. In the past few years, however, Amoco Production Company has drilled 1,475 wells in their Wyoming Districts without a "blowout". Hydrogen sulfide, being heavier than air, will settle in low areas when released and is also readily dispersed by wind. It would not pose an immediate health hazard to other occupants of the project area since there are no private dwellings or ongoing activities within a 2.5-mile radius. There is an established pack trail near the drill site, and thus the possibility of hunters or snowmobilers being within the 2.5-mile radius during drilling operations exists.

As a precautionary measure, and as required by regulations, Amoco has prepared and submitted a Contingency Plan in the event hydrogen sulfide is encountered. A copy of this plan has been included in Appendix D.

There are no significant long-term impacts anticipated for the drilling proposal.

4.13.3.2 Access Alternatives

In regard to Alternatives A, B, and C, short-term health and safety impacts would occur during the maintenance and construc- tion of the road system, with possibly some effect on the existing public traffic. This increase in traffic volume would have a tendency to increase accidents during construction and drilling operations. An increased risk to snowmobilers would occur on portions of Alternatives A, B, and C where snow is plowed on existing roads and both snowmobiles and project traffic may come into contact.

The possibility of landslides and snowslides would exist as long as the access road to the drill site is in use.

Impacts associated with Alternative D would be similar to those associated with Alternatives A, B, and C, with the exception of the additional hazards imposed by helicopter mobilization and support activities. Helicopter operations present the opportunity for in-flight accidents as well as the additional hazards created by handling the materials for an additional time (unloading at the staging area and preparing for air transport to the drill site), and by the nature of loading and unloading the aircraft.

The significant danger presented by a helicopter operation is the chance of industrial injuries at the drill site or of a "blowout" or other disaster occurring during periods in which helicopter flight may be impossible (adverse weather conditions). Medical evacuation or the supply of emergency equipment to the site could not be accomplished. A safety comparison of helicopter to conventional transportation is as follows:

Helicopter

The following statistics have been supplied by the National Transportation Safety Board and are not specific to helicopter mobilization of an oil drill rig.

Accidents	14.01 per 100,000 hours
Injuries	7.19 per 100,000 hours
Fatalities	2.34 per 100,000 hours

It is estimated that a helicopter would be operated 1,040 hours on this project. The accident rate, by either alternative, would then be:

Accidents	0.147 per 1,040 hours =	14.7% chance
Injuries	0.075 per 1,040 hours =	7.5% chance
Fatalities	0.025 per 1,040 hours =	2.5% chance

Conventional (Automobile/Truck)

The following statistics for trucks and commercial vehicles have been supplied by the Motor Carrier Information and Analysis Division, Bureau of Motor Carrier Safety, and are not specific to truck mobilization of an oil drill rig.

Accidents	1.3 per 1,000,000 miles
Injuries	60 per 100,000,000 miles
Fatalities	24 per 100,000,000 miles

Alternative D1:

For Alternative D1, it is 5.35 miles from the helicopter staging area to the location. Each vehicle would then travel 10.7 miles further if the helicopter was not used. It is estimated that

2,500 vehicle round trips would be completed through the life of the project for a total mileage of about 26,750 miles.

The change in accident rate for this portion of the route would then be as follows:

Accidents	0.0348 per 26,750 miles	= 3.48% chance
Injuries	0.0161 per 26,750 miles	= 1.61% chance
Fatalities	0.0064 per 26,750 miles	= 0.06% chance

Alternative D2:

For Alternative D2, it is 9.8 miles from the helicopter staging area to the location via Alternative C. Each vehicle would travel 19.6 miles further if the helicopter was not used. It is estimated that 2,500 vehicle round trips would be completed through the life of the project for a total mileage of 49,000 miles.

The change in accident rate for this portion of the route would then be as follows:

Accidents	0/0637 per 49,000 miles	= 6.37%
Injuries	0.0294 per 49,000 miles	= 2.94%
Fatalities	0.0118 per 49,000 miles	= 1.18%

The above figures indicate that the relative chance of an accident is 4.2 times, of an injury is 4.6 times, and of a fatality is 3.9 times greater if helicopter mobilization is used from the south rather than conventional means.

The relative chance of an accident is 2.3 times, of an injury is 2.6 times, and of a fatality is 2.1 times greater if helicopter mobilization is used from the north rather than conventional means.

4.13.3.3 Impacts Summary

All alternative access roads cross terrain which presents the possibility of mass earth movement or snowslides. The south routes (Alternatives B and C), appear to present the greatest exposure. Alternatives B and C also have the greatest chance for traffic accidents due to the present heavy travel in the Kelly-Gros Ventre Road area. Alternatives B and C also present the greatest chance for snowmobile/project traffic accidents due to the established snow machine trails. Alternative A would be the easiest route to provide escape from, or access to the well site if a release of hydrogen sulfide were to occur. This route accesses the drill site from the windward side and from a higher elevation than the drill site. Alternatives B and C access the route from a lower elevation and from downwind, directly in the path of a potential hydrogen sulfide gas flow.

4.13.4 Cumulative Impacts

Because the probability of significant risk to public health and safety resulting from project implementation is considered to be low, no cumulative impacts are expected to occur.

4.13.5 Mitigation Summary

A hydrogen sulfide contingency plan is required for this project and is found in Appendix D. Monitoring for potential snowslides should be a normal course of winter drilling and production operations. Production operations should be by snow cat to avoid snowslide areas and winter snow plowing. If production is low, operations at the well could be shut down. This would reduce adverse winter impacts.

4.13.6 Unavoidable Adverse Impacts

No unavoidable adverse impacts to Public health and safety are expected to result from project implemention.

4.14 LAND USE CONSTRAINTS AND CONFLICTS

4.14.1 Introduction

Most of the conflicts or constraints that have a physical or biological basis are presented within the environmental consequence sections for the various resources. For instance, that certain portions of the proposed project could reduce the probability that the Visual Quality Level (VQL) objective for visual resources or the Recreation Opportunity Spectrum (ROS) objective for recreation would be maintained is addressed within the respective environmental consequences sections for those resources rather than this section. The reader is referred to each section for details on how the proposed action might affect the existing plans and management for the various resources. Several anticipated conflicts or constraints associated with access routes are of a more general nature and affect several resource areas.

4.14.2 Management Consistency

The consistency of the proposed action and alternatives with existing land use plans for the area of concern would conflict with management direction according to the following criteria:

- Authority to permit the proposed action or to enforce the conditions of approval (mitigation) was inconsistent with the existing land use plan or was not within the realm of authority of the agencies.

- o A conflict arose between or among the existing land use plan and the lease/permit agreement.

- o The proposed action or alternatives deviated from or were inconsistent with the current management direction of the Bridger-Teton National Forest.

Impacts significance criteria, Direct and Indirect Impacts, Impacts Summary, Cumulative Impacts, Mitigation Summary, and Unavoidable Adverse Impacts sections are not presented for this resource but are more appropriately presented under each respective resource discussion.

Current management direction and land use constraints and conflicts associated with the various access alternatives are summarized in Appendix C-5. Where a conflict is identified, discussion of the impacts can be found under the corresponding resource section.

4.15 NO ACTION ALTERNATIVE

4.15.1 Introduction

As required by the NEPA, the consequences of "No Action" must be analyzed. Because of the inherent legal conditions associated with this oil and gas lease and unit agreement, three possibilities exist for No Action. These are 1) No Action - Unconstrained; 2) No Action - As Authorized by the Secretary of the Interior; and 3) No Action - As Authorized by Congress. As explained in Chapter 2, the conditions under which No Action can be considered are constrained by the level at which the authority exists to deny activity upon the lease, and by the terms of the lease and the Sohare Creek Unit Agreement. None of the stipulations, however, give the Secretary of the Interior the authority to deny all drilling activity because of environmental concerns. The denial of all activity on the lease may require Congressional action. The No Action possibilities and associated consequences are explained in the sections following.

4.15.2 No Action - Unconstrained

"No Action" in the strictest sense of the word would essentially leave the condition of the existing environment as is. The existing environment is not a legally designated wilderness area. Certain existing activities pursued by humans have created an altered environment with associated impacts above those of an area totally untouched by human activity. Consequently, implementation of the No Action Alternative would maintain the current level of human activity and associated impacts. The following existing activities and associated impacts would continue:

Geology/Paleontology:

- Geologic hazard and associated risks to humans would continue to be present within the study area. Minor topographic alteration would continue to occur as a result of road improvement and maintenance.

Air Quality:

- The existing good to excellent air quality of the project area would continue. The short-term occurrence of airborne pollutants would continue due to natural fires, from burning logging slash and coal and wood smoke from home heating in Jackson and surrounding areas.

Transportation:

- Risks and hazards of vehicular travel on existing roads would continue. Conflicts between tourist travel and industry related travel would continue. The logging truck use of the existing Flagstaff Creek Road for approximately 250 days per year and 8 trucks per day would continue through 1987, when current timber contracts terminate. The Gros Ventre Road would continue with heavy summer recreation travel, pole logging and firewood cutting June through November, and winter snow machine use with associated risks and hazards to the general public and wildlife.

Soil Resources:

- Soil erosion would continue to occur in areas previously disturbed associated with other existing projects. Many of these areas are difficult to revegetate due to lack of topsoil or poor reclamation technique. Existing landslides along the Alternative A access route would continue to move and block the existing roadway.

Water Resources:

- Sedimentation of streams as a result of natural erosion and erosion from existing disturbed areas would continue, although water quality in the area is consider good to excellent. The fords across Cottonwood Creek would continue to be a source of increased sediment to Cottonwood Creek as well as channel bed disruption. Consumptive use of water by riparian plant species, wildlife, habitat for fish and for irrigation would continue.

Fisheries:

- Fishery resources of the project area would continue to be affected by current sedimentation levels as a result of

existing activities in the area involving soil disturbance or streambed disruption. Fishing pressure would continue or increase with the projected increase in recreation use of the Teton County area.

Vegetation, Timber, and Range Resources:

- Vegetation within the study area would continue to be disturbed as a result of on-going activities such as timber harvest, livestock and wildlife grazing, and infestations of mountain pine beetle and dwarf mistletoe. Existing disturbed areas would continue to revegetate naturally or through the efforts of humans. Timber harvest, including firewood cutting, would continue in the project area. Range livestock would continue to utilize the forage of the area. Livestock-vehicle collisions would continue to occur resulting in the injury or death of livestock.

Wildlife:

- Impacts related to the existing transportation system within the project area would continue. These impacts include direct mortality of wildlife due to animal/vehicle collision, stress caused by harassment, and disruption and displacement of elk, grizzly bear, and other wildlife in areas where migration corridors are currently traversed by roads.

- Impacts related to recreational activities including direct mortality due to hunting, stress due to harassment, disturbance and disruption by snowmobile activity, and snow skiing.

- Reduction or alteration of habitat and forage due to timber harvest activities, livestock grazing, and natural infestations.

Visual Resources:

- The existing contrast in area, line, form, color, and texture would continue to exist as a result of in-place linear facilities such as the Flagstaff and Gros Ventre Roads or transmission lines and timber harvest areas, as well as from dust generated from construction and maintenance of existing roads and from vehicular travel.

Recreation:

- The estimated 17,000 recreation visitor days (RVDs) associated with the northern access route and 25,000 RVDs associated with the southern route would continue. Recreation demand within the area will continue to increase with a subsequent increase in visitation. The area may become more

crowded and more competition for the same activities could occur.

Socioeconomics:

- The Togwotee Lodge and Goose Wing summer and winter businesses and the two outfitter guide businesses would go undisturbed and without revenue loss.
- A recreation based economy would continue to occur in the project area.

Cultural Resources:

- Recreationists using the project area would continue to discover and perhaps retain cultural artifacts in the area.

Health and Safety:

- Health and safety risks and hazards associated with vehicular travel, logging industry, and recreation in the project area would continue.

4.15.3 No Action - As Authorized by the Secretary of the Interior

The lease and unit agreement contain special stipulations which enable the Department of the Interior, in consultation with the Department of Agriculture, to ensure protection of sensitive resource values before approving any surface disturbing activity. Two situations exist under which the Secretary of the Interior has the authority to impose No Action:

a. If any one of the special stipulations (see chapter II, No Action Alternative) could not be acceptably mitigated for any one alternative, then an exception to the stipulation could not be granted. Rather, it would require denial of the APD and consideration and analysis of another alternative(s). Consequently, the impacts of "No Action" under these conditions would mean a delay in the leaseholders right to develop their lease. It would mean that drilling would still be allowed at some location on the lease, with reasonable mitigation measures.

b. The Secretary of the Interior has the power to deny activity when such activity would "detrimentally affect" an endangered or threatened species. The Unit Agreement stipulation which provides for this reads as follows:

> The Forest Service is responsible for assuring that the area to be disturbed is examined, prior to undertaking any ground disturbing activities on lands covered by this lease to determine effects upon any plant or

animal species listed or proposed for listing as endangered or threatened species, some restrictions to the operator's plans or even disallowances of use may result.

If the U.S. Fish and Wildlife Service's Biological Opinion concluded that the proposed action and alternatives would be likely to jeopardize the continued existence of an endangered or threatened plant or animal species or their habitat, then the APD may be denied in part or in whole.

If, after consultation with the U.S. Fish and Wildlife Service, it is determined that the impact to endangered or threatened species or their habitat would occur in part of the area, the impacts of "No Action" would mean a delay in the leaseholders right to develop their lease. It would mean that drilling would still be allowed at some location within the unit, with reasonable mitigation measures, where endangered or threatened species would not be affected.

If it is determined that the impact to endangered or threatened species would occur regardless of where the activity took place, then the lease rights may be denied. The leaseholders (lessees) would be denied the right to develop their leases because, "the Department is required by 16 U.S.C., S 1536(a)(2)(1982) to assure any action authorized by it is not likely to jeopardize the continued existence of the threatened or endangered species, or result in the adverse modification of the critical habitat of such species...;" and as the Interior Board of Land Appeals found,..."the regulation must be construed to authorize the Department to bar surface disturbing activity which would have an impact the Department is not legally permitted to authorize." [(Sierra Club Legal Defense Fund, Inc., 84 IBLA 311, 92 I.D. 37 (1985)]. [(Glacier-Two Medicine Alliance et al., 88 IBLA 135 & 146, (85-445)].

Therefore, the impacts of "No Action" under these conditions (action detrimentally affects endangered or threatened species) may preclude the leaseholders from developing all or part of their lease. If the APD is denied, the social and environmental impacts identified for the Proposed Action and Alternatives would not occur. However, other impacts would occur and are discussed below:

- The purpose of drilling the exploratory oil well would not be fulfilled. The knowledge of whether oil or gas occurs within the structural closure of the Sohare Anticline would not be realized, nor would the potential for contributing domestic natural oil and/or gas to reduce the national dependance on foreign supplies.

- All leaseholders would be adversely affected equally. Denial would create an undetermined financial burden on the leaseholders.

- Such lease cancellation may require that just compensation be paid to the lessees, since the lease is viewed as property. This would create an undetermined financial burden on the U.S. Government directly and the private taxpayer indirectly.

4.15.4 No Action - As Authorized by Congress

As explained in Chapter II, and as stated by the Department of the Interior Regional Solicitor, the Secretary of the Interior does not have the power to deny APDs strictly on environmental grounds, absent specific stipulations in the lease [(Solicitors Opinion M-36910 (Supp.), The BLM Wilderness Review and Valid Existing Rights 88 I.D. 909 October 5, 1981)]. Generally, drilling must be allowed at some location on the lease, with reasonable mitigation measures.

Generally, without congressional authorization, the Secretary could only suspend the lease, pursuant to Section 39 of the Mineral Leasing Act, pending consideration by the Congress of the grant of authority to preclude drilling and provide compensation to the lessees.

The impacts of this Alternative would be the same as described under 1(b) above, No Action-under conditions where the action may detrimentally affect endangered or threatened species. In addition, the following impacts would also occur:

- Leaseholders (lessees) would be denied their legal rights for development of their various leases. The first premise of federal oil and gas leases, under the Minerals Leasing Act of 1920, as amended, is that the oil and gas lease between the U.S. Government (lessor) and lessee constitutes an contractual agreement with give rights and restrictions, subject to relevant laws and regulations. This is supported in Department of the Interior. In these particular instances, a blanket denial of APDs (as under this alternative) would constitute a cancellation of the leases, and therefore a breach of contract, not within the powers of the Secretary of the Interior. Such lease cancellation may require that just compensation be paid to the lessees, since the lease is viewed as property. This would create an undetermined financial burden on the U.S. Government directly, and the private taxpayer indirectly.

CHAPTER 5

5.0 COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

5.1 Introduction

A comparison of significant environmental impacts that may occur as a result of implementing the Proposed Action or alternatives is presented in the following discussion and tables. The comparative analysis was based on information contained in Chapter 4, Environmental Consequences. Significant impacts were determined on the basis of impact significance criteria developed for each resource element (Chapter 4). Many of the significant impacts could be fully mitigated through the implementation of special mitigation measures which would reduce site or area-specific impacts to levels not considered specific. These impacts would be considered mitigatable unavoidable adverse impacts. Other significant impacts could not be fully or acceptably mitigated, and therefore would remain as significant unavoidable adverse impacts. Resource-specific impacts are compared by action alternative in Table 5-1.

5.2 Drill Site

Construction and operation of the drill site and worker camp would require approximately 6 acres of vegetation clearing, soil disturbance, cut and fill of earth materials, and placement of facilities on the drill pad. The duration of the construction, drilling, and reclamation phases would be approximately one year. Should economic quantities of petroleum product be found during drilling, then production from the well may last for up to 30 years. Environmental consequences would result for each resource. However, these consequences would not be considered significant in the short term for the following resources: geology/paleontology, air quality, transportation, soils, water resources, vegetation, range resources, fisheries, wildlife, cultural resources, and health and safety. In contrast, significant impacts would result due to drill site construction and operation of the well should it go into production, for the following resources: timber, visual resources, recreation, socioeconomics, and land use. Significant impacts to cultural resources are not likely to occur, however, a survey for cultural artifacts would be required to determine the presence or absence of such artifacts, and, therefore, significance of cultural resource impacts.

Trees of merchantable size would be removed during site clearing. The commercial value of the trees is considered to be significant

Table 5-1. Comparison of significant unavoidable adverse impacts for the Proposed Action and alternatives[1].

Discipline/Topic	Alt. A	Alt. B	Alt. C	Alt D1	Alt D2
General					
-new road construction (mi)	3.3	13.2	11.6	0	0
-total disturbance (ac)	26.0	86.0	76.3	10.0	10.0
Geology/Paleontology	NSI	NSI	NSI	NSI	NSI
Air Quality	NSI	NSI	NSI	NSI	NSI
Transportation	NSI	NSI	NSI	NSI	NSI
Soils	MI	MI	MI	NSI	NSI
-road const. on slopes in excess of 40% (mi)	0.7	2.2	1.6	0	0
-maximum slope (%/ft)	70/200	80/3000	80/200	0	0
Water Resources/ Fisheries	MI	MI	MI	MI	MI
-road construction within 500 feet of stream environment (mi)	2.2	5.1	5.7	0	0
-road construction within 500 feet of stream environment (ac)	13.3	30.9	34.5	0	0
-stream crossings (new or major re-construction)	2	7	6	0	0
Vegetation and Timber	MI	MI	MI	MI	MI
-loss of wetlands (ac)	2.5	8.5	8.5	0	0
-loss of forests (ac)	6.8	31.6	19.6	0	0
-range resources	NSI	NSI	NSI	NSI	NSI

1 - NA: not applicable
NSI: no significant impacts
MI: significant unavoidable adverse impact, mitigatable
UMI: significant unavoidable adverse impact,unmitigatable
UNK: unknown impact until survey is completed

2 - Assumes an exploration well, thus includes helicopter cost to transport rig and equipment into the well location, and drilling support costs.

3 - These values are approximations, since some potential effects are unquantified. See Tables 4-9 and 4-10 for more detail.

Table 5-1. continued

Discipline/Topic	Alt. A	Alt. B	Alt. C	Alt. D1	Alt. D2
Wildlife	MI	MI	MI	MI	MI
-road through wildlife habitats (mi)					
-grizzly I	7.9	0	0	3.6	0
-grizzly I-II interface	12.9	0	0	12.9	0
-total grizzly	20.8	0	0	16.5	0
-moose winter range	1.2	27.5	26.4	1.2	18.8
-elk winter range	0	27.5	26.4	0	18.8
-elk migration	9.0	6.0	6.0	0	0
-big horn sheep/mule deer winter range	0	14.0	14.0	0	14.0
-elk caving habitat	0	13.0	13.0	0	13.0
Visual Resources	UMI	UMI	UMI	UMI	UMI
-drill site					
-short-term	UMI	UMI	UMI	UMI	UMI
-long-term	MI	MI	MI	MI	MI
-production	UMI	UMI	UMI	NA	NA
-road construction in violation of VQL objectives (mi)	1.1	13.2	11.6	0	0
-helicopter staging area	NA	NA	NA	MI	UMI
	NA	NA	NA	UMI	UMI
Recreation	UMI	UMI	UMI	UMI	UMI
-ROS reclassification (ac)	23,431	19,502	19,502	23,431	19,502
-deterioration of recreation experience	UMI	UMI	UMI	UMI	UMI
Social					
-direct	UMI	UMI	UMI	NSI	NSI
-indirect	UMI	UMI	UMI	UMI	UMI

1 - NA: not applicable
NSI: no significant impacts
MI: significant unavoidable adverse impact, mitigatable
UMI: significant unavoidable adverse impact, unmitigatable
UNK: unknown impact until survey is completed

2 - Assumes an exploration well, thus includes helicopter cost to transport rig and equipment into the well location, and drilling support costs.

3 - These values are approximations, since some potential effects are unquantified. See Tables 4-9 and 4-10 for more detail.

Table 5-1. continued

Discipline/Topic	Alt. A	Alt. B	Alt. C	Alt. D1	Alt. D2
Economics					
-outfitted elk hunting					
-exploration	NSI	MI	MI	MI	MI
-production	MI	UMI	UMI	NA	NA
-non-outfitted elk hunting					
-exploration	NSI	NSI	NSI	UNK	UNK
-production	UMI	UMI	UMI	NA	NA
-snowmobiling					
-exploration	MI	UMI	UMI	MI	UMI
-production	UMI	UMI	UMI	NA	NA
-summer use					
-exploration	MI	NSI	NSI	UNK	UNK
-production	UMI	UMI	UMI	NA	NA
-construction and reclamation cost estimate	$667,290	2,091,040	1,670,810	2,328,610[2]	3,210,110
-net economic effect[3]					
-exploration	$657,645	1,369,520	1,236,205	876,638	1,336,121
-production	$12,982,364	12,975,622	12,842,307	NA	NA
Cultural Resources	UNK	UNK	UNK	UNK	UNK
Health and Safety	NSI	NSI	NSI	NSI	NSI

1 - NA: not applicable
NSI: no significant impacts
MI: significant unavoidable adverse impact, mitigatable
UMI: significant unavoidable adverse impact,unmitigatable
UNK: unknown impact until survey is completed

2 - Assumes an exploration well, thus includes helicopter cost to transport rig and equipment into the well location, and drilling support costs.

3 - These values are approximations, since some potential effects are unquantified. See Tables 4-9 and 4-10 for more detail.

The loss of the timber would be considered significant if no monetary compensation is provided. However, direct purchase of the timber by the applicant or sale of the timber at market value would fully mitigate this impact.

Visual resources would be significantly impacted since the activity associated with construction and operation of the site would violate the objectives of the Partial Retention Visual Quality Level (VQL) assigned to the area surrounding the drill site. In addition, the contrast in area, line, form, texture, and color created by project activities would significantly impact the aesthetics of the area. The duration of the significant impacts would last throughout the exploratory phase and to some point beyond until the site is revegetated. Should the well go into production, the duration of significant impacts would last throughout the production phase and to some point beyond until the site is revegetated. These impacts for the most part could not be fully mitigated or reduced to levels commensurate with visual management objectives.

Recreation resources would be significantly impacted because the activities associated with construction and operation of the site would violate the objectives of the Primitive Recreation Opportunity Spectrum (ROS) assigned to the area surrounding the drill site. In addition, the drilling activities could displace recreationists who utilize the area for hunting and other activities. These impacts would last throughout the exploration phase and beyond until the site is revegetated. If the well were to go into production, these impacts would last throughout the duration of the production phase and beyond until the site is revegetated. These impacts for the most part could not be fully mitigated or reduced to levels commensurate with the recreation management objectives.

Socioeconomic resources would be significantly impacted for the same reasons as discussed above for recreation resources. Outdoor recreation is of importance to the local economy, local residents, and the tourist industry. Consequently, any significant impact to recreation would carry through to socioeconomic resources as well. A portion of the costs of project construction and wages earned would remain in the local economies of Jackson and/or Dubois, Wyoming, which would be considered a significant beneficial impact.

Significant impacts to land use would occur as a result of project construction. Most of these impacts relate directly to management objectives as discussed under individual resource sections. These impacts could not be fully mitigated or reduced to levels not considered significant.

5.3 Access Alternatives

5.3.1 Alternative A

Implementation of Alternative A could cause significant impacts to soils, water resources, vegetation and timber, wildlife, visual resources, recreation and socioeconomics. These significant impacts would be fully mitigatable for soils, water resources, vegetation and timber, and wildlife. No significant impacts would occur to geology/paleontology, air quality, transportation, range resources, and health and safety environments. It is unlikely that cultural resources would be impacted, however, a survey would be required to confirm this conclusion.

Significant impact to soils would primarily occur as a result of constructing new roads across approximately 0.7 miles of slopes in excess of 40 percent. With special road design and construction techniques applied, impacts that could result from construction on these steep slopes could be reduced to levels not considered significant. A special Geotechnical Road Feasibility Evaluation Report would be required before a final decision is made on road selection.

Under this alternative approximately 2.2 miles of major road reconstruction and new road construction would occur within 500 feet of the stream environment, which would be of major concern in regard to hydrology and fisheries resources. The 500-foot distance relates to a 'no surface occupancy' well field unit stipulation applicable to this project. The impacts that could occur as a result of construction of roads within this distance of streams could be fully mitigated or reduced to levels not considered significant.

Approximately 2.5 acres of wetlands and 6.8 acres of forested vegetation types would be cleared during road construction. The loss of these vegetation types would be considered significant. However, these significant impacts would be fully mitigatable or could be reduced to levels not considered significant by revegetating wetlands and direct compensation for the timber loss or sale at current market value.

Significant impacts to wildlife would occur under this alternative. These impacts include roading through 20.8 miles of grizzly bear management situations 1 and 2, 1.2 miles of moose winter range, and 9.0 miles of elk migration. Cumulative impacts due to this alternative and other impacts that have occured and are occuring in the analysis area may affect the grizzly bear through reduction in habitat effectiveness, displacement into less desireable habitat, and reduction in recruitment to their populations. This impact primarily relates to road desities in excess of 1.0 mile per square mile within MS-1 areas in the analysis area. Impacts associated with road construction ac-

tivities and increased vehicle use could be fully mitigated or reduced to levels not considered significant.

Approximately 1.1 miles of road construction activity inconsistent with the management objectives of the assigned Visual Quality Level (VQL) of Partial Retention would take place under this alternative. This would be considered to be a significant impact that could not be mitigated. In addition the contrast in area, line, form, texture, and color caused by project construction would be considered significant. This impact would remain significant until the cut-and-fill slopes were revegetated, or the road totally reclaimed, depending on whether the well goes into production.

Implementation of this alternative would also result in a Recreation Opportunity Spectrum (ROS) classification change of approximately 18,542 acres where activities associated with this alternative would be inconsistent with the objectives of current ROS delineations. Under an exploration scenario, no significant impact would occur to dispersed recreationists, including hunters, since they would be displaced for only one season. However, under a one-well production scenario, these users would be displaced for the duration of the project. This displacement would be considered significant. The long-term displacement of these users could indirectly impact the recreation experiences of users in adjacent areas where the displaced users would likely move to as an alternative.

No direct significant impacts would occur to the social environment in the short term under this alternative. However, under the one-well production scenario, the probable changes in lifestyles of users that would be displaced as a result of activities under this alternative would be considered significant. Significant indirect impacts would likely occur under both exploration and production from one-well scenarios due to the high probability of invoking organized sentiment against the project.

The implementation of Alternative A would not cause significant economic impact to commercial and non-commercial outdoor recreation-oriented activities under an exploration scenario. However, under the one-well production scenario, the long-term displacement of outfitted and non-outfitted elk hunting and snowmobiling use of the affected area would be significant. Of particular concern would be the displacement of the outfitter. Serious economic hardship would result since long-term displacement of the operation would occur under a producing-well scenario. The impacts to the commercial trailride operation could also be significant under a production scenario.

5.3.2 Alternative B

Implementation of Alternative B would cause significant impacts to soils, water resources, fisheries, vegetation and timber, wildlife, visual resources, recreation, socioeconomic, and land use environments. These impacts would be fully mitigatable or could be reduced to levels not considered significant for all these disciplines except visual resources, recreation, socioeconomics, and land use. It is unlikely that cultural resources would

be significantly impacted, however, a survey for artifacts would be required to substantiate this conclusion.

Approximately 2.2 miles of road construction would be required across slopes in excess of 40 percent. Significant impacts would likely result, however, these impacts would be fully mitigatable or could be reduced to levels not considered significant through the application of special road design and construction techniques.

Under this alternative approximately 5.1 miles of major road reconstruction and new road construction would occur within 500-feet of the stream environment, which would be of major concern in relation to hydrology and fisheries resources. Significant impacts would likely result from road construction within this distance of streams. However, these impacts would be fully mitigatable or could be reduced to levels not considered significant.

Approximately 8.5 acres of wetlands and 31.6 acres of forested types would be cleared during road construction. However, these significant impacts would be fully mitigatable as discussed above under Alternative A.

Significant impacts would likely occur to wildlife as a result of project construction. These impacts would relate to road construction through 27.5 miles of both moose and elk winter range, 6.0 miles of elk migration corridor, 14.0 miles of bighorn sheep and mule deer winter range, and 13.0 miles of elk caving habitat. Impacts associated with road construction activities and increased vehicle use could be fully mitigated or reduced to levels not considered significant.

Under this alternative, approximately 13.2 miles of road construction activity inconsistent with management objectives of the assigned VQL of Partial Retention would occur. This violation would be considered to be a significant impact which could not be mitigated. In addition, the contrast in area, line, form, texture, and color caused by project construction would be considered significant. This impact would remain significant

until the cut-and-fill slopes were revegetated, or the road totally reclaimed, depending on whether the well goes into production.

Implementation of this alternative would result in a classification change on approximately 19,502 acres where activities associated with this alternative would be inconsistent with the objectives of current ROS delineations. Under an exploration scenario, no significant impact would occur to hunters since they would be displaced for only one season. However, snowmobilers and snowmobile concessionaires would be significantly impacted. Under a producing-well scenario, similar but more severe impacts than under Alternative A would occur to recreationists, including users of developed campgrounds along the Gros Ventre road, dispersed recreationists, snowmobilers, and outfitted and non-outfitted hunters.

No direct significant impacts would occur to the social environment in the short term under this alternative. However, under the producing-well scenario, the probable changes in lifestyles of users that would be displaced as a result of activities under this alternative would be considered significant. These impacts would be more pronounced under this alternative than under Alternative A due to the greater number of homes, ranches, and recreationists distributed along the Gros Ventre road and immediate environs. Significant indirect impacts would likely occur under both exploration and production scenarios due to the high probability of invoking organized sentiment against the project.

The implementation of Alternative B would not cause significant economic impact to commercial and non-commercial outdoor recreation-oriented activities under an exploration scenario due to one season of operation. However, under one-well production, the long-term displacement of outfitted and non-outfitted elk hunting and snowmobiling use of the affected area would be significant. Of particular concern would be the displacement of the outfitter. Serious economic hardship would result since long-term displacement of the operation would occur under a producing-well scenario. The impacts under this alternative would be similar but more pronounced than under Alternative A due to reasons discussed above for recreation.

As discussed under Drill Site above, significant impacts relating to land use constraints and conflicts would occur. These impacts relate to management objectives of areas traversed by the road as discussed in greater detail under individual resources.

5.3.3 Alternative C

Implementation of Alternative C would cause significant impacts to soils, water resources, fisheries, vegetation and timber,

wildlife, visual resources, recreation, socioeconomic, and land use environments. These impacts would be fully mitigatable or could be reduced to levels not considered significant for all these disciplines except visual resources, recreation, socioeconomics, and land use. It is unlikely that cultural resources would be significantly impacted, however, a survey for artifacts would be required to substantiate this conclusion.

Impacts that would occur as a result of implementing this alternative would be very similar to those described above for Alternative B. Therefore, only the disciplines which would be impacted differently than as discussed above for Alternative B will be discussed here. Approximately 1.6 miles of slopes in excess of 40 percent would be traversed by new road construction and approximately 5.7 miles of new road construction or major road reconstruction would occur within 500 feet of streams. Approximately 19.6 acres of forested types would be cleared, and 26.4 miles of both moose and elk winter range would be crossed. Approximately 11.6 miles of new construction would occur in an area delineated as Partial Retention VQL.

5.3.4 Alternative D

Implementation of Alternative D would cause significant impacts to wildlife, visual resources, recreation, socioeconomic, and land use environments. No significant impacts would occur to geology/paleontology, air quality, transportation, soils, water resources, fisheries, or vegetation, timber and range resources, under either the D1 and D2 staging areas. It is unlikely that cultural resources would be significantly impacted. A survey for artifacts would be required to substantiate this conclusion.

Significant impacts that could occur to wildlife as a result of helicopter access using the northern, or D1 staging area include primarily disruption to big game while utilizing winter habitat, elk migration, and grizzly bear. Significant impacts that could occur to wildlife as a result of helicopter access using the southern, or D2 staging area include primarily disruption to big game while utilizing winter habitat, elk migration, and elk calving.

Construction of the D1 staging area would conform to the VQL objectives assigned to the area. Construction of the D2 staging area would be inconsistent with the VQL objectives assigned to the area. Helicopter mobilization would add additional impact over the roading alternatives due to the highly visible operations, however, the activity would be short-term, lasting for only one season.

Similar impacts would occur to recreation under D1 as described for Alternative A, and for D2 as described for Alternatives B and C. Impacts would tend to be more short-term than long-term since

the only major disturbance, and therefore reclamation, would occur at the drill site in contrast to the roading alternatives involving more land disturbance.

Socioeconomic and land use impacts would be the same under D1 as described for Alternative A, and for D2 as described for Alternatives B and C.

5.4 Summary

Helicopter mobilization utilizing the northern (D1) staging area would have the lowest magnitude of unavoidable adverse impacts of all the action alternatives. Implementation of the southern (D2) staging area would cause impacts of greater magnitude than the northern (D1) staging area but substantially lower magnitude impacts than the roading alternatives for all resources other than recreation, social, and economics. Impacts to recreation, social, and economic environments would be slightly less under implementation of the southern (D2) staging area than the roading alternatives. Most of the unavoidable adverse impacts to recreation, social, and economics associated with the southern (D2) staging area would occur along the Gros Ventre road.

Of the roading alternatives, Alternative A would cause the least impact to all resources. Alternative B and C would cause equivalent unavoidable adverse impacts to the recreation, socioeconomic, and land use environments. Under Alternative B, less impact to water resources and fisheries would result than under Alternative C. However, Alternative C would cause less impacts to soils, vegetation and timber, wildlife, and visual resources than Alternative B.

Under a one-well production scenario, unavoidable adverse impacts would be more severe than under an exploration scenario. Most of the non-significant short-term impacts would convert to significant long-term impacts due to the 20 to 30 year duration of operation. Alternative A would cause the lowest magnitude of significant unavoidable adverse impacts of Alternatives A, B, and C.

CHAPTER 6

6.0 MITIGATION AND MONITORING

The mitigation measures and monitoring requirements that follow would be included in the Conditions of Approval for the drilling proposal, if project approval were granted. The measures and requirements were developed in response to impacts identified in the Environmental Consequences chapter of this EIS (Chapter 4) and through issues identified during the scoping process. They are inclusive of the measures identified by the lessee/operator in the Application for Permit to Drill (APD). The measures and requirements describe how construction, drilling, and reclamation would be managed to assure compliance with the applicable lease and Unit Area stipulations and resource limitations identified during the interdisciplinary analysis. The following measures and requirements apply to Alternatives A, B, C, and D unless otherwise noted. If deemed necessary, to minimize impacts or in light of new facts, the following measures may be added to, modified, or selectively withheld. Determination of final mitigation measures and monitoring requirements will be made by the authorized officer (AO) after consultation with the Inter-disciplinary team (ID team), who will have made recommendations based on on-the-ground situation analysis.

This chapter has been divided into two principal sections: Mitigation Measures (Section 6.1) and Monitoring Requirements (Section 6.2). Each of these is further divided into subsections based on the particular approval and/or implementation phase concerned. Because of the organizational design of this chapter (the implementation phases), repetition of measures is inherent. It is important to note that, if project approval were granted, notice to proceed would be contingent upon all required plans (i.e. construction, operation, reclamation, and monitoring) being approved unless otherwise provided by the Authorized Officer (AO). An outline of the contents in this chapter is provided in the Table of Contents.

6.1 MITIGATION MEASURES

6.1.1 Administrative Measures

1. Prior to completion of the FEIS, Amoco will be required to complete a Geotechnical Road Feasibility Evaluation and Report. The geotechnical analysis will be completed for the agency preferred or selected alternative after the release of the DEIS but before the completion and release of the FEIS to facilitate a decision relative to road construction, operation, and maintenance feasibility. The evaluation and report must demonstrate that road construction is feasible; the alignment required in order for it to be feasible; the construction methods and techniques which must be implemented; any special measures necessary to avoid or prevent stream sedimentation and landslides; and requirements for successful reclamation.

2. Amoco will adhere to the applicable lease and Sohare Creek Unit Stipulations during all phases of the proposed drilling activity, or provide for written waiver of the stipulation(s) where adherence is not possible but acceptable with proper mitigation.

3. All project activities will be conducted in such a manner that full compliance is made with applicable laws and regulations (e.g., the Clean Water Act and the Endangered Species Act), and the conditions of approval attached to the approved Application for Permit to Drill.

4. Amoco shall protect all survey monuments, witness corners, reference monuments, and bearing trees against disturbance during construction, operations, maintenance, and rehabilitation. If any monuments, corners, or accessories are destroyed, obliterated, or damaged during construction, operation, or maintenance, Amoco shall secure the services of a Registered Land Surveyor to restore the disturbed monuments, corners, or accessories, at the same locations, using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands of the United States, latest edition. Amoco shall record such survey in the appropriate county and shall send a copy to the BLM Wyoming State Office, P.O. Box 1828, Cheyenne, Wyoming 82001.

5. Amoco shall conduct all activities directly or indirectly associated with the construction, operation, and maintenance of this facility within the limits of the rights-of-way and permits. In the event that areas outside of the rights-of-way or permits are needed, Amoco shall obtain a separate use authorization.

6. Amoco shall comply with the applicable federal and state laws and regulations concerning the use of pesticides (i.e., insecticides, herbicides, fungicides, rodenticides, and other similar substances) in all activities or operations under this use authorization. Amoco shall obtain from the AO approval of a written plan prior to the use of such substances on National Forest or public lands. The plan should be submitted not later than December 1, of any calendar year that covers the proposed activities for the next fiscal year (e.g., December 1, 1986, deadline for fiscal year 1985 actions). If need for emergency use of pesticides is identified, the use must be approved by the AO. The use of substances on or near the right-of-way or permit area shall be in accordance with the approved plan. A pesticide shall not be used if the Secretary of the Interior has prohibited its use. A pesticide shall be used in accordance with its registered uses and within other limitations if the Secretary has imposed limitations. Pesticides shall not be permanently stored on public lands.

7. No signs or advertising devices shall be erected on the project area or highway leading thereto, without prior approval by the FS as to locations, design, size, color, and message. Signs meeting state and county standards, as approved by the FS, warning the public of heavy equipment, will be placed by Amoco along approved access routes into the project area prior to transporting drilling equipment and during drilling operations.

8. On federally permitted roads, stop signs, and advance warning signs will be installed in areas of intersecting traffic, construction, and conditions of dangerous operation. A 25 mph speed limit on collector roads will be enforced by Amoco on their personnel and contractor personnel.

9. All garbage and rubbish will be hauled from the drill site to the state approved sanitary landfill for disposal. Any garbage or refuse materials collected on location will be stored in bear-proof containers approved by the FS and hauled away at least once a week. No open burning of garbage or refuse will be allowed at the drill site or resident campsite.

10. Used engine oil which is changed on federal lands will be stored in suitable containers and arrangements made for delivery to secondary refineries. No fuel, oil, or other hydrocarbon spills are permitted. If such a spill accidentally occurs, the AO will be notified immediately and corrective measures undertaken as directed.

11. Permittees and other regular users of public lands affected by construction of the project will be notified in advance of any construction activity that may affect their businesses or operations. This will include, but not be limited to, signing of temporary road closures, and notifications of proposed removal and/or cutting of fences, and disturbances to range improvements or other use-related structures.

6.1.2 Preconstruction Planning and Design Measures

All Administrative Measures (Section 6.1.1) are required considerations where applicable to the planning and design phase.

6.1.2.1 General Measures

12. Amoco will submit for approval a road improvement plan for the existing Flagstaff and Leidy Creek Roads (Alternatives A and D1), or the Gros Ventre and Cottonwood Creek Roads (Alternatives B, C, and D2), depending on the alternative selected. The road improvement plan will specify road work needed to accommodate the drilling operation. The plan will be agreed to in advance of any road improvement work by Amoco and the Forest Service (FS). Approval of this plan will be required in advance of anticipated start work date.

13. Critically sensitive areas such as landslides, steep terrain, stream crossings, sideslopes greater than 40 percent, and wetlands will be carefully evaluated in the Geotechnical Road Feasibility Evaluation and Report to minimize potential road construction impacts. The following will be incorporated or considered in the design plan: cross-sectional engineering diagrams, channel grades and geomorphic stability, ditch location, culverts, inlet and outlet controls, up and down stream erosion protection, vegetative and riparian buffers, erosion control and spoil placement, topsoil depth and availability, topsoil salvage and storage criteria, road surface grades, crown and road surface durability characteristics, equipment staging schedules, slash disposal and revegetation/stabilization of disturbed areas. The ID team will address the above points during their field review.

    Cut and fill slopes will be reduced to minimum gradients where possible to minimize the potential for significant surface runoff and erosion. Water turnouts should be constructed in road ditches near crossings over live streams so drainage water and sediment are diverted into vegetated areas or filters and sediment traps next to streams and not directly into streams.

14. Crossings of perennial streams will be accomplished using bridges or arched culverts. Culvert crossings of perennial streams will not be allowed, unless by arch-type culvert that would maintain slope, alignment, and integrity of stream channel.

15. Where the right-of-way crosses streams or wet areas, the banks will be stabilized to limit erosion during the clearing operation. Construction techniques will minimize damage to streambanks and channels. Channel stabilization evaluations will be completed during ID team visits and construction dates and procedures will be verified by the team. If construction through wetlands or streams is deemed necessary, construction will be scheduled to occur during the driest period, when possible, to minimize damage and to coincide with the clearing operations. Wherever sensitive riparian vegetation is identified, specific construction criteria will be adopted.

16. Amoco will prepare and submit to the BLM and FS for approval a comprehensive drill site design plan that describes the details of construction including design layout, cut and fill quantities and areas, topsoil depths and availability, spoil and topsoil storage, access, worker camp layout and construction, locations of berms, drain ditches and other water diversion structures deemed necessary for runoff, erosion and sediment control, and locations of sediment settling ponds. The details of reserve pit location and construction will also be presented. The drill site design should provide locations for the pad and reserve pit that would have the least environmental influence and minimal amount of cut and fill. The comprehensive plan will also include a prescription for temporary revegetation of disturbed areas requiring seeding for site stabilization.

17. Access road, and well and camp site preparation for new construction will consist of the removal of vegetation and sufficient amounts of topsoil for reclamation purposes as specified by the AO. Topsoil depth will be determined during the ID team visit. Existing and future stockpile areas and topsoil depths will be designated in site-specific reclamation plans, prior to construction disturbance. The vegetation and topsoil stripped from the site will be stockpiled at locations specified by the AO.

18. Prior to start of construction, Amoco will submit a reclamation plan to the FS and BLM for approval. The plan will address reclamation needed in the event drilling is productive or non-productive. The plan will also include provision for the establishment of a reclamation monitoring program to be developed and submitted following drilling with the application to either install production facilities, or to

abandon the location and access road. The plan will be recommended for approval to the BLM by the Buffalo District Ranger if Alternative A or D1 is approved or the Jackson District Ranger if Alternative B, C, or D2 is selected. The work plan will be approved in advance of anticipated start work date.

19. Amoco shall schedule and attend a preconstruction conference with the AO and designated representative prior to commencing construction activities. Amoco or designated representative and all contractors or agents involved with construction shall attend this conference. The company shall contact the AO or designated representative at least 10 working days (two weeks) prior to the anticipated start of construction to schedule this conference.

6.1.2.2 Resource-Specific Measures

6.1.2.2.1 Geology/Paleontology

Mitigation measures 13 and 19 also apply to this resource.

20. The company will provide a qualified paleontologist who would be approved by the AO. The paleontologist will conduct an intensive (pedestrian) survey along the access route and at the drill site and campsite as directed by the AO. Surveys will be completed on the area identified and an appropriate report prepared and submitted to the AO for approval before construction begins. The road alignments or drill and camp sites may be adjusted slightly to avoid significant paleontological resources at the direction of the AO.

6.1.2.2.2 Air Quality

21. The generation of fugitive dust is likely. When an air quality, visuals, soil loss, or safety problem is identified, immediate abatement will be initiated. Water will be used on roads. Additives may be used if approved by the AO. This measure will be particularly important in areas of high recreation use such as at developed campgrounds.

6.1.2.2.3 Transportation

Mitigation measures 12, 13, 18, and 19 also apply to this resource.

22. Amoco will include the Oil and Gas Roading Guidelines for Region 4 (FS) and the findings of the Geotechnical Road Feasibility Evaluation Report in their road design plans.

23. All snow to be removed from sites will be stored so as to minimize erosion and mass movement. Suggested snow storage areas and snow fences will be shown on site-specific reclamation plan maps.

    Where access roads are plowed during the winter months in big game winter range, maintain escape openings every 200 yards to facilitate the easy exit of moose and other big game animals.

24. Amoco shall obtain necessary access permits from the county or Wyoming Highway Department for approach to a county, state, or U.S. highway prior to commencing any construction activity associated with the project.

6.1.2.2.4 Soils

Mitigation measures 13, 16, 18, and 19 also apply to this resource.

6.1.2.2.5 Water Resources

Mitigation measures 13, 16, 18, and 19 also apply to this resource. See Section 6.2 for water quality monitoring requirements.

25. All phases of the project, including road and drill site construction, maintenance and rehabilitation, shall be guided by the dictates of the Clean Water Act. All hazardous substances, including fuels, shall be controlled (via dikes, etc.,) so as to prevent their accidental discharge into waterways. All tanks regardless of size shall be completely protected, as shall any aggregate of containers.

26. Minor routing variations during access road layout should be implemented to avoid steep slopes adjacent to streams. Minimize the areal extent of disturbance in the vicinity of streams. A 100-foot wide buffer strip of natural upland vegetation should be left in place between all construction activities and stream channels.

27. An oil spill prevention control and countermeasures (SPCC) plan will be developed in accordance with criteria contained in 40 CFR Part 112, dated December 11, 1973. The plan should address in detail the immediate availability of oil spill containment and cleanup resources, such as sorbent materials, T-siphon dam installation, manpower, methods to pick up oil from water surface, etc.

6.1.2.2.6 Fisheries

All measures referenced above for Water Resources also apply to this resource. See Section 6.2 for fisheries monitoring requirements.

6.1.2.2.7 Vegetation, Timber, and Range Resources

Mitigation measures 12, 13, 16, 19, and 26 also apply to this resource. See Section 6.2 for reclamation monitoring requirements.

28. The detailed road construction and drill site design and construction plans will include minimization of vegetation clearing, particularly in sensitive areas such as in wetlands.

6.1.2.2.8 Wildlife

Mitigation measures 13, 16, 18, 19, and 28 also apply to this resource. See Section 6.2 for wildlife monitoring requirements.

29. Conduct a thorough education program for project personnel, familiarizing them with the circumstances that are likely to result in human-bear/other animal encounters and measures that need to be taken to minimize the potential for such encounters. Such measures would include the prescribed federal agency procedures for food handling and storage, the disposal of garbage, and vehicle collisions.

30. Incorporate into the comprehensive construction and operation plan schedules that spring season construction and drilling activities in riparian habitats will be avoided in the spring to protect spring grizzly bear use areas.

31. Sensitive wildlife areas such as critical wildlife winter and elk calving habitats and stands of whitebark pine (used by the grizzly) should be avoided where feasible by minor routing variations and/or seasonal closures. If unavoidable, other methods of minimizing disturbance should be implemented.

6.1.2.2.9 Visual Resources

Mitigation measures 12, 13, 16, 18, 19, and 28 also apply to this resource.

32. The comprehensive construction, operation, and reclamation plan should provide for minimization of cumulative disturbance of vegetation and exposure of soil, and the retention of existing linear vegetation to screen, shade, and break up the linear character of the access road during alignment and design.

6.1.2.2.10 Recreation

Mitigation measures 12, 18, 19, 29, and 32 also apply to this resource.

33. Amoco and the FS, in cooperation with the Wyoming Game and Fish Department, should provide assistance to displaced outfitters, impacted in the long term by production operations, in locating a new hunt area not currently utilized. This should be done prior to the initiation of construction.

34. The comprehensive construction, operation, and reclamation plan should include provisions to survey for new segments or portions of pack trails and snowmobile trails to replace those impacted by project construction and operation.

6.1.2.2.11 Socioeconomics

Mitigation measures 19, 29, 30, 33, and 34 also apply to this resource.

6.1.2.2.12 Cultural Resources

35. Prior to any surface disturbing activity, Amoco, in consultation with the AO and Wyoming State Historic Preservation Officer (SHPO), shall conduct a Class III inventory to determine all archeological and historical sites on all lands where surface disturbance is likely to occur. If there is a significant finding, the agencies shall develop a cultural resource treatment plan outlining procedures for identifying and evaluating historic and prehistoric resources within the EIS area. The treatment plan will also outline methods for mitigating adverse effects to significant cultural resources that cannot be avoided.

6.1.2.2.13 Health and Safety

36. The comprehensive construction, operation, and reclamation plan should incorporate measures to avoid and minimize risk to the general public and all project employees.

6.1.3 Construction Measures

All Administrative and Preconstruction Measures (Section 6.1.1 and 6.1.2) are required considerations where applicable to the construction phase.

6.1.3.1 General Measures

37. All construction activities will be slope staked by Amoco and approved by the FS prior to start of construction.

38. A qualified inspector(s), approved by the FS, will be required on-site during all construction and reconstruction activities to assure contractor compliance with approved road and drill site design plans.

39. Aggregate sources for any new construction material for use in drill site and access road construction and reconstruction will be located by Amoco. These sources, including timing for extraction, necessary reclamation, and site-specific analysis must be completed and approved by the FS prior to use.

40. Upon conclusion of construction and operations, all construction materials, related litter, and debris shall be disposed of in accordance with instruction from the AO.

41. Amoco shall submit a certification of construction, when all development and rehabilitation has been completed. At that time, a joint compliance check of the right-of-way or permit area shall be made by Amoco and the AO or designated representative to determine compliance with the terms and conditions of the use authorization. Amoco shall perform, at its own expense, any required modifications or additional reclamation work for compliance with such terms and conditions.

6.1.3.2 Resource-Specific Measures

6.1.3.2.1 Geology/Paleontology

Mitigation measure 20 also applies to this resource.

42. Construction workers and other employees associated with the project should be informed about and on the lookout for paleontological resources of significance which may be encountered during construction. Any discoveries shall be reported immediately to the AO. Appropriate disposition will be determined by a qualified paleontologist in consultation with the AO and State of Wyoming.

6.1.3.2.2 Air Quality

Mitigation measures 9 and 21 also apply to this resource.

6.1.3.2.3 Transportation

Mitigation measures 1, 5, 7, 8, 10, 12, 13, 14, 22, and 23 also apply to this resource.

43. Land grading and clearing will be done only on the minimum area required for construction. Existing or constructed roads will be used for vehicle travel, where possible. Generally, no off-road use of vehicles or equipment will be allowed, especially in streambeds and other fragile areas without the approval of the AO in conjunction with regulatory agencies (e.g., Army Corps of Engineers, National Park Service).

44. Amoco will schedule construction activities, including their own and their contractors' large truck activities, to avoid the following high recreation demand weekends, which will normally cover three-day periods: Memorial Day, Independence Day, Pioneer Day, Labor Day, and the first two weekends of big game season (this may differ with species).

45. During the spring and fall months, when road moisture content is high, as determined by the AO, Amoco and their contractors will limit any construction activity in the project area to periods when the ground is frozen. Any exception to this condition must be approved by the AO. This measure will help preserve the stability of road beds, maintain travel surfaces, and protect against increased stream sedimentation and soil loss.

46. Amoco and their contractor will use front and rear vehicle escorts for oversized, overweight loads to maximize safety, as determined by the AO. This procedure will help maximize the operational safety of equipment transport related to the project.

47. Amoco shall permit free and unrestricted public access to and upon the area accessible by existing roads except where designated closed by the AO. To facilitate this control, all current and new road closures will be maintained during the life of the project. This measure will protect the public, wildlife, and livestock from hazards associated with the project.

48. Amoco shall be allowed, with prior written approval from the AO, to close roads to public access for limited periods during the construction phase of the project should it be

necessary to do so to provide further protection of public health and safety.

6.1.3.2.4 Soils

Mitigation measures 1, 2, 5, 10, 13, 15, 17, 18, 21, 23, 27, 28, 43, 45 also apply to this resource.

49. The drill pad and camp area will be designed and constructed to disturb the smallest practical area. All precautions necessary to stabilize structures will be taken during construction. Qualified supervision will be provided during the installation of all erosion control structures including the construction of berms, dikes, trenches, and the outslope fill.

50. At all sites, removal and storage of subsoil and spoil will be according to approved engineering designs submitted with the APD or right-of-way (ROW) permits. Care will be taken not to mix spoil with topsoil. Erosion will be controlled on spoil stockpiles through appropriate construction design with mulching and/or revegetation. Whenever possible, topsoil will not be stored for extended periods (over two years) and will be used for immediate reclamation.

51. All disturbed areas not required for use during operation will be stabilized and revegetated immediately following construction to minimize erosion of soil.

52. Topsoil removed from the site will be managed to maintain its viability over the life of the project by applying all topsoil to the areas of disturbance outside the working area. These areas would be reseeded according to the reclamation plan. At abandonment, necessary topsoil would then be available from these areas.

6.1.3.2.5 Water Resources

Mitigation measures 1, 2, 3, 5, 6, 10, 12, 13, 14, 15, 16, 18, 21, 23, 26, 43, 45, 49, 51, and 52 also apply to this resource.

53. The well will be cased and cemented to a minimum depth of 500 feet to minimize degradation of freshwater aquifers due to migration of contaminants. Additional casing and cementing will be required as determined necessary by the AO.

54. To assure the reserve pit is not in danger of overflowing, the maximum containment level will not exceed 75 percent of total pit capacity. If leakage is found outside the pit, drilling operations will be shut down until the problem is corrected.

55. At a minimum, the subsoil material within which the pit is to be constructed should be inspected for stability and permeability to assess whether additional measures such as reinforcement and/or lining are required. The reserve pit will be lined with either native clays or synthetic liner because the actual degree or amount of leakage would be unknown.

56. Off-site disposal of reserve pit fluid materials would be required at a Wyoming DEQ authorized site, or disposal by other methods (e.g., solidification, aeration) as approved by the AO.

57. The reserve pit should be constructed in cut or in compacted and stabilized fill to minimize the potential of reserve pit failure and subsequent contamination of water resources.

58. Should a shallow water table be intersected during drill pad construction, the site will be de-watered with cut-off and internal drains and a filter fabric and graded aggregate placed over the site.

59. Unless otherwise approved in writing by the AO, dikes or cofferdams shall be installed to separate concrete work areas from lakes or streams during construction. Mobile ground equipment shall be kept within the right-of-way or permit area and out of the waters of lakes, streams, or rivers except as permitted by the AO.

60. Staging areas for stream crossing equipment will be located outside of the stream's riparian zone to reduce the possibility of silt entering into streams and to reduce disturbance to vegetation in the riparian zone. A maximum width construction disturbance of 25 feet would be used in riparian areas to reduce disturbance. Variances to this must be approved by the AO.

61. Crossing of perennial streams should be conducted during the fall low flow period. This will minimize habitat degradation by limiting the amount of suspended solids and turbidity generated during in-stream construction.

62. Where road construction is absolutely necessary in stream channels, channel alteration and disruption should be minimized by returning the channel to pre-disturbance geometry and substrate size and type to minimize natural channel readjustments.

63. During construction of the wellpad, as deemed necessary, drainage or interceptor ditches will be installed above cuts. Drainage ditches and sediment control structures (designed for the 10-year/24-hours storm event,) may be

installed below the fill. Water (with a flow less than the 10-year/24-hours storm event) will be diverted and/or collected, before being discharged from the disturbed area. Where necessary, culverts will be installed to control erosion from the access road and appropriate vegetation buffers will be left.

6.1.3.2.6 Fisheries

All mitigation measures referred to above for water resources also apply to this resource.

6.1.3.2.7 Vegetation, Timber, and Range Resources

Mitigation measures 1, 2, 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 23, 26, 32, 43, 49, 50, 51, 52, and 63 also apply to this resource.

64. Commercial timber removed from the access road right-of-way and the drill site will be cut to current FS standards by Amoco. Volume of timber removed will be determined in advance of cut by the FS. Amoco will be billed for the timber removed at current FS appraised rates.

65. When timber is cleared, all tree stumps will be cut as low as practical, but not higher that 14 inches. The trees will be limbed and stacked at the edge of the right-of-way, permit, etc. area. During cleanup, all clearing and grubbing debris (slash) will be piled for burning or buried as specified by the AO.

66. Preclearing of mountain brush and tree-covered areas prior to dozer and maintenance blade work will be required. Preclearing may involve hand cutting brush and trees and removing them to designated areas. (If merchantable timber is involved in clearing on the right-of-way, permit area, etc., it must be harvested in accordance with the terms of the FS timber sale contract.)

67. Brush (shrub) clearing along the margins of access roads during construction will be limited to trimming and/or crushing to avoid disturbing root systems. This measure will be effective in limiting the amount of shrub vegetation disturbed along the access right-of-way. By not disturbing the root system, some crushed or clipped shrubs will resprout and revegetate the right-of-way more quickly. This will reduce soil erosion and speed restoration of wildlife habitat. Any blading would require authorization in advance.

68. The reserve pit will be fenced (three stands of barb wire, 48 inches high) to keep out livestock and wildlife. Fencing

will remain in place until a final disposition of drilling fluids, muds, and cuttings is approved by the AO.

69. Disturbance of range improvements such as fences, roads, and watering facilities during the construction and maintenance of roads must be kept to an absolute minimum. Immediate restoration of any damage to improvements to at least their former state will be required. Functional use of these improvements must be maintained at all times. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. A gate or cattleguard acceptable to the AO shall be installed in the gate opening and kept closed when not in actual use. Where a permanent road is to be constructed or maintained, cattleguards shall be placed at all fence crossings.

70. If a natural barrier used for livestock control is broken during construction, Amoco will adequately fence the area to prevent drift of livestock. All fencing constructed by Amoco will meet FS design requirements with input from the WGFD. Fence specifications will be determined on case-by-case basis.

6.1.3.2.8 Wildlife

Mitigation measures 3, 5, 6, 8, 9, 11, 13, 14, 15, 18, 19, 23, 26, 29, 30, 31, 33, 43, 44, 47, 60, 67, 68, 84, 85, and 86 also apply to this resource.

71. The speed limits on access roads will reduce the potential for incidence of animal-vehicle collisions. If night travel is necessary, further reduce the speed limit for such travel to minimize animal/vehicle collisions.

72. Reduce road densities in the project area by restricting public access to the drilling operation and closing some of the roads in existence within the project area to minimize impacts on wildlife.

73. To minimize displacement and stress of animals, Amoco will prohibit worker vehicles from stopping, except for emergencies, in big game winter habitat while there is snow on the ground; and in elk calving habitat between May 15 and June 30 (Alternatives B,C, and D2).

74. Amoco personnel and their contractor personnel will report sightings of grizzly bears and their sign to regulatory authorities and cooperate in their bear management programs.

75. Avoid removal of whitebark pine, a preferred source of food for the grizzly bear, during construction activities where possible.

76. Prohibit public access to reopened, reconstructed, and new roads utilized during this operation.

77. To facilitate big game movements and minimize the potential for injuries, road access rights-of way will not be fenced.

78. Prohibit construction work, extensive use of ground crews, and helicopter operations within or over designated elk calving habitats between May 1 and June 30.

79. Restrict helicopter operations to the most direct and least obtrusive flight lines possible.

80. State wildlife laws and regulations will be posted in conspicuous places at the job sites. All construction and production workers will be provided with training on wildlife and potential impacts to habitat and species as determined necessary by the state wildlife management agency. This will help to reduce incidents of violation of wildlife laws.

81. During construction and operation phases, dogs, excepting guard dogs and seeing eye dogs, will be prohibited from the well site and construction sites. This will help to reduce harassment to wildlife.

82. In the event Amoco finds it necessary to remove a beaver pond which has flooded an existing road, the applicant will initiate consultation with the WGFD and FS.

83. Any active golden eagle nests found within one mile of the project activities will be protected from harassment during the critical nesting period (March through May) because of provisions established by the Bald Eagle Protection Act, which requires the protection of the golden eagle and its nests.

6.1.3.2.9 Visual Resources

Mitigation measures 1, 2, 5, 7, 9, 12, 13, 16, 17, 18, 19, 21, 23, 32, 34, 40, 43, 49 and 51 also apply to this resource.

84. Reduce visual impacts associated with road construction by utilizing various construction methods of cribbing, stabilization fabrics or other techniques to stabilize soils in areas of steep slope or unstable soils and thus reduce the overall area impacted by cut and fill requirements. Amoco

will incorporate these methods into the access road design plan.

85. During drill pad construction, Amoco will remove only those trees which are located in the area to be disturbed by drill pad construction so that as much natural screening of the drill site is retained as possible. Clearing of trees will be selective in order to create irregular edges which can simulate natural clearings. Trees to be retained for natural screening will be marked in advance of construction by the FS.

86. The clearing of timbered, dense shrub, and scenic areas shall be done in accordance with the approved clearing plan and shall be limited to minimum width necessary to prevent interference of trees and other vegetation with the facility construction. The AO may require clearing to be "feathered or graded" with curved or undulating boundaries to lessen visual "tunnel" effect. Where construction enters timber, including dense shrub, from meadows or other open areas, The AO may require clearing to be "feathered" into the timber in order to retain maximum natural vegetative patterns. The authorized Officer may require a landscape architect to assist in the design of the clearing plan.

6.1.3.2.10 Recreation

Mitigation measures 2, 5, 8, 9, 11, 19, 23, 29, 33, 34, 36, 21, 44, 46, 47, 48, 76, 84, 85, and 86 also apply to this resource.

87. Reduce impacts related to conflicts between the use of access routes by snowmobiles and project vehicles by posting appropriate warning signs, by using advanced warning vehicles (pilot cars) preceding heavy trucks and equipment; by scheduling project vehicle use and snowmobilers use of the affected road sections so that they won't overlap. (Such scheduling would include minimal project vehicle use on weekends or other peak snowmobile use periods.) Other partial mitigation could include the development, where feasible, of new snowmobile tracks parallel to, but off of the affected segments of the access routes.

6.1.3.2.11 Socioeconomics

Mitigation measures 5, 11, 29, 31, 33, 34, 36, 44, 46, 47, 69, 70, 71, 73, 80, and 87 also apply to this resource.

88. Local contractors and laborers should be utilized to the fullest extent possible.

6.1.3.2.12 Cultural Resource

Mitigation measures 2, 3, 5, 19, and 35 also apply to this resource.

89. Any cultural resource (historic or prehistoric site or object) discovered by Amoco or any person working on behalf of Amoco shall be immediately reported to the AO. The company shall suspend all operations in the area of such discovery until written authorization to proceed is issued by the AO. An evaluation of the discovery will be made by the AO and SHPO to determine appropriate actions to prevent the loss of significant cultural values. The company will be responsible for the cost of evaluations and for mitigation. Mitigation may include rerouting or excavations, and any decision as to proper mitigation measures will be made by the AO after consulting with the company.

6.1.3.2.13 Health and Safety

Mitigation measure 2, 3, 5, 6, 8, 11, 19, 21, 22, 23, 24, 25, 27, 29, 34, 36, 44, 45, 46, 47, 48, 53, 76, 79, and 87 also apply to this resource.

90. Construction workers and other employees associated with the project should be informed about and on the lookout for geologic hazards including rock slides and avalanches.

91. Sanitation facilities installed on the drill site, helicopter staging areas, and worker camp site locations will be approved by the Wyoming DEQ.

92. Amoco shall perform all work with explosives and flammable material in such a manner as not to endanger life or property. All storage places for explosives and flammable material shall be marked.

6.1.4 Reclamation Measures

All Administrative, Preconstruction, and Construction measures (Sections 6.1.1, 6.1.2, and 6.1.3) are required considerations where applicable to the Reclamation phase.

6.1.4.1 General Measures

93. The reclamation plan will encompass site-specific reclamation techniques to be employed on homogeneous portions or segments of the project.

94. All disturbed areas shall be recontoured and reclaimed to the approximate original contour of the ground surface.

95. ORV barriers will be installed at points along existing roads where access to the reclaimed ROW could be gained. Where necessary, these barriers will consist of boulders, pylons, brush piles, or other feasible barriers as required on a site-specific basis.

6.1.4.2 Resource-Specific Measures

6.1.4.2.1 Geology/Paleontology

No specific reclamation mitigation has been identified for this resource.

6.1.4.2.2 Air Quality

96. Dust abatement should be performed during reclamation if determined to be necessary by the AO.

6.1.4.2.3 Transportation

No specific additional reclamation measures have been identified for this resource.

6.1.4.2.4 Soils

Mitigation measure 94 also applies to the reclamation phase of the project.

97. All areas not needed for production on the wellpad and access road must be recontoured and rehabilitated following the drilling phase. All topsoil stripped from disturbed areas will be respread to a uniform depth over the unused portions of the wellpad and access road and revegetated. Topsoil will be hauled in from surplus areas designated during preconstruction topsoil availability analysis. The determination of the area necessary for operation will be made by the AO in consultation with Amoco.

98. Spoil generated at the drill site will be replaced to original or design contours as the placement of production facilities allows. In those areas where final spoil grading is not possible, spoil will be graded to a gentle slope capable of maintaining a temporary vegetation cover for erosion control. Subsoil and suitable substrate materials will be spread over spoil.

99. All backfilled and graded spoil material will be ripped and scarified on the contour to reduce compactions, thus increasing revegetation potential. All grading and recontouring will be conducted under the supervision of a

reclamation specialist and will correspond to the natural topography of the area.

100. Following topsoil applications, seedbed preparation procedures will be determined on the a basis of the physical and chemical characteristics of the topsoil and the physical nature of the site itself. Chiseling, disking, harrowing, and surface manipulation including pitting (gouging), furrowing, and cultipacking may be included in seedbed preparation and surface water runoff control.

101. Straw mulch should be applied to all seeded areas at a rate of approximately two tons per acre or as directed by the AO and crimped into the soil surface. A mulch will be certified weed-free by agents of the county of origin. Other surface soil protection and seedbed enhancement such as netting, jutting, or excelsior will be employed on steep areas or on areas with reclamation difficulty.

6.1.4.2.5 Water Resources

Mitigation measures 94, 97, and 98 also apply to the reclamation phase of this project.

102. All stream channels will be returned to their natural state as quickly as possible. Such construction on National Forest Land will be managed under the restrictions in the FS and Department of Agriculture Policy Statement No. 2019, dated July 8, 1980.

103. The riparian zone of stream crossings shall be rehabilitated immediately after construction is completed. Until riparian vegetation is reestablished, the disturbed area shall be protected by installing sediment filters between the water edge and the disturbance on each side of the stream to prevent sediment contamination of the stream and/or erosion of the banks.

104. All drainage control structures will be designed to function with minimal maintenance throughout the duration of the reclamation phase including ditches, water bars, berms, and energy dissipators.

6.1.4.2.6 Fisheries

The measures referred to above for water resources also apply to fisheries.

6.1.4.2.7 Vegetation, Timber, and Range Resources

Mitigation measures 94, 97, 98, 100, 101, and 103 also apply to this vegetation, timber and range resource reclamation.

105. Restoration (recontouring) of disturbed sites will commence as soon as possible. Seed mixes will be designed to meet certain objectives as determined by the AO. The objectives of seeding and planting will generally include: 1) prompt site stabilization to limit wind and water erosion, 2) establishment of vigorous stands of desirable species to limit invasion by noxious weeds, 3) restoration of predisturbance productivity, 4) provision for food and cover for domestic livestock and wildlife, 5) enhancement of aesthetic values, 6) compliance with site-specific revegetation requirements, and 7) regenerating and self-supporting vegetation.

106. Seeding will be accomplished when seasonal and weather conditions are most advantageous. Seeding methods include drilling, broadcasting, or hydroseeding as deemed appropriate on a site-specific basis. Seeding rates will be adjusted for individual species within the mixture and for the specific conditions of the site being seeded. Revegetation efforts on slopes will implement various degradable matting techniques to hold seed in place until germination. Terracing may also be necessary on steep slopes. Provisions for reseeding, following any seeding failure, will be made.

107. Planting of trees, shrubs, and other plants in higher stages of development will be dependent upon the site-specific revegetation goals involved as directed by the AO.

108. Whitebark pine seedlings will be transplanted into the disturbed areas from adjacent stands where the project would impact whitebark pine stands.

109. A noxious weed control program will be implemented if invasion of these unwanted species occurs in reclaimed areas.

110. A site specific mitigation plan will be implemented to replace wetland functional values lost due to project construction through wetland areas. The mitigation will be coordinated through the Department of Army Corps of Engineers.

6.1.4.2.8 Wildlife

All measures referred to above for the Vegetation, Timber, and Range Resources also apply to wildlife.

111. All reclamation and revegetation activities and procedures should include criteria for re-establishing wildlife habitat and forage as soon as possible after construction.

6.1.4.2.9 Visual Resources

Mitigation measures 94, 97, 98 and 103 also apply to visual resources.

112. All reclamation and revegetation activities and procedures should include criteria for minimizing contrasts between natural areas and disturbed areas as soon as possible after construction.

No specific reclamation mitigation has been identified for the following resources:

Recreation, Socioeconomics, Cultural, and Health and Safety.

6.1.5 Operation and Maintenance Measures

All Administrative, Preconstruction, Construction, and Reclamation Measures (Section 6.1.1, 6.1.2, 6.1.3, and 6.1.4) are required considerations where applicable to the Operation and Maintenance Phase.

6.1.5.1 General Measures

113. If the well is productive, prior to the start of operation, Amoco will develop an operation and maintenance plan which will be approved and executed under the direction of the AO.

6.1.5.2 Resource-Specific Measures

6.1.5.2.1 Geology/Paleontology

No specific operation and maintenance mitigation has been identified for this resource.

6.1.5.2.2 Air Quality

No specific operation and maintenance mitigation has been identified for this resource.

6.1.5.2.3 Transportation

114. Amoco shall be responsible for preventive and corrective road maintenance throughout the duration of the project. This may include, but not be limited to, blading roadway, cleaning ditches and drainage facilities, dust abatement, or other requirements as directed by the AO.

115. Periodic inspection of the access road should be accomplished to minimize the opportunity for maintenance problems

that may increase risks to workers, residents, and/or tourists.

6.1.5.2.4 Soils

All measures referenced in 6.1.4.2.4 also apply to this section.

116. If the well is found to be a producer, reclamation of the area not needed for production will begin during the first appropriate season. In the reclaimed area immediately adjacent to the production pad, topsoil for the ultimate reclamation of the production pad will be contoured to provide a deep layer of topsoil. At cessation of production (abandonment), the pad area will be reclaimed using this extra topsoil. This procedure will avoid long-term topsoil stockpile, erosion control, and enhance topsoil viability.

6.1.5.2.5 Water Resources

117. All surface water, erosion, and sedimentation control structures should be inspected and maintained on a regular basis.

6.1.5.2.6 Fisheries

Implementation of the mitigation measures itemized under water resources will avoid significant impacts to fisheries.

6.1.5.2.7 Vegetation, Timber, and Range Resources

118. All disturbed areas not needed during operations that have been revegetated should be monitored to determine if sufficient protection is afforded these areas from erosion and offsite sedimentation. Remedial spot revegetation or stabilization will be required on any areas found to be deficient in site stability or protection.

119. The well pad area will be fenced to contain disturbance and to protect revegetated areas from damage due to domestic animals and ORVs. (Exceptions to entire location fencing may be granted by the AO on a case-by-case basis.) All fencing will be done in accordance with specifications approved by the AO.

120. All existing range improvement structures such as cattle guards, fences, and gates that could be affected by project activities will be maintained in good operating condition throughout the duration of the project.

6.1.5.2.8 Wildlife

If Alternative A is implemented, the following compensatory measures would be required to ensure that the grizzly bear and its habitat would not be impaired:

121. Production from the proposed exploratory well could be transported by a pipeline which would parallel the access road. The pipeline would be buried in the cut side of the access road and would carry the product to storage tanks located at or near Highway 287. The product would then be trucked from there to market.

122. Maintenance and operation of the well would be facilitated by a single vehicle which would use the access roads no more than twice a week. The vehicle would be inspected and maintained to ensure that operational noise is that of reasonable quietness.

123. Vehicular speed would not exceed 15 mph.

124. The access road would be closed (locked gate) to public vehicle use at the point where the existing road meets the South Fork of Spread Creek.

125. The access road would be closed seasonally (15 April - 15 June) for operational and maintenance purposes to minimize potential disturbance of grizzly use and feeding in riparian areas along the road.

126. Other selected existing roads within the grizzly bear Management Situation 1 and 2 habitat areas would be closed and revegetated. Cumulative closed road mileage would equal or exceed new road construction associated with Alternative A. The following measures should be implemented:

    - During the construction and drilling phase of the operation a gate closure will be erected on Forest Road 30120 (North Fork of Spread Creek Road) as close to its intersection with the Flagstaff Road (30100) as topographic conditions dictate. No use of motorized vehicles by the administration or public should be allowed behind the gate.

    - To ensure progress towards the grizzly bear recovery program objectives of reducing open road density levels to 1.0 mile per square mile or less, 4.2 miles of existing logging roads behind the gate closure proposed in the first item above should be ripped, disked, and seeded prior to snowfall during the construction phase of the operation.

- o If the well is a producer all of the remaining roads within the proposed mitigation area (approximately 12 linear miles) will be ripped, disked, and seeded. In addition, the gate closure described in the first recommendation above will be replaced with a permanent "tank trap" closure that will exclude all motorized and wagon train traffic from the proposed mitigation area.

- o A gate closure will be erected on the Flagstaff Road at its closure with U.S. Highways 26-287. This closure will be appropriately signed and maintained so as to preclude public use of the Flagstaff Road during the spring of the year (until June 15) when bears are emerging from dens and using riparian habitats throughout the life of the project (exploration and production phases).

127. Commercial timber harvest should not be programmed by the FS within the area unless it would benefit grizzly bear and other wildlife.

128. If the exploratory well is productive, but should prove unfeasible to operate without potential jeopardy to the grizzly bear, the agencies would reinitiate Section 7 consultation with FWS to determine measures necessary to prevent a jeopardy situation.

129. The Interagency Grizzly Bear Guidelines pertinent to the Bridger-Teton National Forest will be implemented in addition to any of the compensatory actions listed above. These involve but are not limited to guidelines on food storage and garbage disposal, firearms within the work camp, and other restraints. A complete listing of the guidelines is included within the Wildlife Section of Chapter 3.

130. If the proposed exploratory well is a producer and well field development is proposed, an additional separate environmental analysis and Biological Assessment, and consultation process with the FWS and WGFD will be required.

6.1.5.2.9 Visual Resources

131. Amoco shall precolor or paint all permanent structures (on site for a period longer than 90 days after construction) a flat, non-contrasting color that is harmonious with the adjacent landscape. Exceptions to this requirement would be determined on a case-by-case basis by the AO because of varying levels of sensitivity, or structures which require safety coloration in accordance with Occupational Safety and Health Administration requirements. Color selection will be approved by the AO.

6.1.5.2.10 Recreation

132. To minimize impacts to recreation in the project area, all unauthorized vehicular access to the project area will be prohibited beyond the points where current access is restricted.

No specific operation and maintenance mitigation has been identified for the following resources:

Socioeconomics, Cultural Resources, and Health and Safety.

6.1.6 Abandonment Measures

6.1.6.1 General Measures

Mitigation measures listed under section 6.1.4.2 also apply to this phase.

133. Prior to termination or abandonment of the facilities authorized by a grant, Amoco shall contact the AO to arrange a joint inspection of the authorized use area. The inspection will be held to agree on an acceptable abandonment and rehabilitation plan. The AO must approve the plan in writing prior to Amoco commencing any abandonment and/or rehabilitation activities. The plan may include removal of drainage structures or surface material, recontouring, replacement of topsoil, seeding, mulching, etc.

6.2 MONITORING REQUIREMENTS

6.2.1 General Requirements

1. As part of the monitoring program, all project components will be inspected regularly throughout the life of the project to determine whether additional mitigation measures would be required to ensure that complete and successful reclamation is maintained.

6.2.2 Resource-Specific Requirements

6.2.2.1 Geology/Paleontology

No specific monitoring requirements have been identified for this resource.

6.2.2.2 Air Quality

No specific monitoring requirements have been identified for this resource.

6.2.2.3 Transportation

No specific monitoring requirements have been identified for this resource.

6.2.2.4 Soils

Monitoring requirement 6 also applies to this resource.

2. After the second growing season following initial reclamation efforts, the ID team will determine significant problem areas that may exist, based upon the review of goals and procedures in the reclamation plan. The problem areas will receive additional rehabilitation measures, and monitoring will be established with a photo point system. Photo point locations and the specific method will be determined by the ID team and Amoco.

6.2.2.5 Water Resources

3. All runoff, erosion, and sediment control structures will be monitored by Amoco on a regular basis to assess adequate function. If problems are identified, immediate action will be taken to resolve the problem.

4. Amoco will be required to design and implement a specific surface water monitoring program for the project. This plan should include establishing baseline water quantity and quality prior to project implementation. Once baseline conditions are established, any significant change in either

streamflow quantity or quality can be detected and appropriate remedial action taken. Surface water chemistry monitoring should continue until successful reclamation has been attained.

6.2.2.6 Fisheries

5. Amoco will be required to design and implement, in cooperation with the Wyoming Game and Fish Department, a fisheries and fisheries habitat monitoring program. One or more sites should be selected prior to construction to establish baseline conditions, and the population size and composition should be monitored once a year following construction until successful reclamation has been attained. Depending on the alternative selected, monitoring sites should be located on Kettle Creek, Sohare Creek, and Cottonwood Creek below the confluence of Sohare Creek to allow monitoring of the upstream-most fish population and habitat (i.e. macroinvertebrates) receiving flows from the area of the well site.

6.2.2.7 Vegetation, Timber, and Range Resources

6. Amoco will be required to design and implement a monitoring program to evaluate the progress of the revegetation and restoration program. Both qualitative and quantitative monitoring will continue after reclamation until the reclaimed areas are released by the AO. The FS, BLM, other appropriate cooperating agencies, and Amoco representatives will review and evaluate restoration efforts annually until successful reclamation has occurred. Release of the reclaimed area will occur once the reclaimed site meets or exceeds performance standards determined by the AO. Should problem areas be identified, immediate remedial action will be taken to correct the problem(s).

6.2.2.8 Wildlife

7. Amoco would assist in the funding of a monitoring program to observe and document the magnitude and type of impact the operation has on wildlife. The actual conduct of the monitoring should be performed by the Wyoming Game and Fish Department. Pre-project observations to quantify the baseline conditions should be performed prior to the initiation of construction and operation. The species that should be emphasized and techniques used will vary depending on the alternative selected. Changes in the status of grizzly bear and elk migration should be emphasized if the well is accessed from the north (A, D1), while wintering big game and elk calving would be emphasized if the south access is used (B, C, D2).

No specific monitoring requirements have been identified for the following resources:

Visual Resources, Recreation, Socioeconomics, Cultural Resources, and Health and Safety.

CHAPTER 7

7.0 CONSULTATION AND COORDINATION

7.1 Introduction

An EIS must be prepared when a federal government agency considers approving an action within its jurisdiction which may result in significant impacts to the human environment. An EIS aids federal officials in making decisions by presenting the environmental facts on a proposed project and its alternatives. The first step in preparing an EIS is to determine the scope of the project and the range of actions alternatives, and impacts to be included in the document.

The Council on Environmental Quality regulations (40 CFR, Parts 1500-1508) require an early scoping process to determine the significant issues related to the proposed action and alternatives which should be addressed in the EIS. The principal purpose of the scoping process is to identify important issues, concerns and potential impacts that require detailed analysis in the EIS and to eliminate insignificant issues and alternatives from detailed analysis. Scoping makes the EIS process more efficient by reducing paperwork and time spent on unimportant areas while focusing on the important ones.

The Amoco Production Company Sohare Creek Unit Exploratory Oil Well No. 1-35 EIS was prepared by a third-party contractor, with the Forest Service (FS), Bridger-Teton National Forest, Jackson, Wyoming, and the Bureau of Land Management (BLM), Rock Springs District Office, Rock Springs, Wyoming, joint lead agencies.

7.2 Public Participation

Initially, an environmental assessment (EA) was prepared on the Amoco proposal. Public issues and comments regarding the Amoco proposal were solicited for incorporation into the project environmental assessment completed in December, 1986. This was accomplished by a Scoping Statement mailed to the general public. The statement was prepared jointly by the FS and BLM and distributed to the public on October 30, 1985. The Scoping statement described the proposed action to be analyzed in the environmental assessment, identified preliminary issues and concerns, and established timing needs and requirements for public involvement. Issues and concerns identified through this scoping period were subsequently incorporated into the environmental assessment.

Based upon the evaluation of the potential adverse and significant environmental effects documented in the Sohare EA, the FS and BLM concluded that this proposal may significantly affect the human environment. Therefore, an EIS was required to ensure

that all relevant factors are available for consideration in making the final decision.

Following the decision by the Responsible Officials (Rock Springs District Manager, BLM Wyoming; Bridger-Teton Forest Supervisor, FS Wyoming) that an EIS would be required, a follow-up Scoping Statement was prepared and distributed to the public on January 26, 1987, requesting additional comment regarding the Amoco proposal and alternatives for incorporation into the EIS. There were twenty-two written responses to the Scoping Statement. A Notice of Intent (NOI) that an EIS was being prepared and that the Scoping Statement was available for comment was published in the Federal Register, Vol. 52, No. 9, page 1532 on January 14, 1987. The issues and concerns identified by the public are summarized in Chapter 1.

7.3 Public Involvement

In the course of preparation of the draft DEIS for the proposed project, the joint lead agencies (BLM and FS) have communicated with and received input from many Federal, State, County and local agencies; elected representatives; environmental and citizens groups; industries; and individuals. Many of these people responded to the Scoping Statement. The following agencies, groups, and individuals have provided input and/or will receive copies of the draft DEIS.

7.3.1 Federal Government Agencies

Department of Agriculture:
  Forest Service
  Soil Conservation Service
  Rural Electrical Administration
Department of the Army:
  Corps of Engineers
Department of Commerce:
  National Oceanic and Atmospheric Administration.
Department of Defense
Department of Energy
Department of Housing and Urban Development
Department of the Interior:
  Bureau of Indian Affairs
  Bureau of Mines
  Bureau of Reclamation
  Fish and Wildlife Service
  National Park Service
  Geological Survey
Department of Labor
Department of Transportation
Federal Energy Regulatory Commission
Federal Highway Administration

Interstate Commerce Commission
Environmental Protection Agency
Advisory Council on Historic Preservation

7.3.2 State Government Agencies

Archives, Museums, and Historical Department
Conservation Commission
Board of Agriculture
Economic Development and Stabilization Board
Department of Environmental Quality:
  Air Quality Division
  Land Quality Division
  Solid Waste Management
  Water Quality Division
Energy Conservation Office
Geological Survey
Industrial Siting Council
Oil and Gas Conservation Commission
Public Service Commission
Recreation Commission
State Engineer
State Forester
State Game and Fish Department
State Highway Department
State Planning Coordinators Office
Water Development Commission

7.3.3 Local Governments

Teton County
Fremont County

7.3.4 Environmental Groups and Others

Jackson Hole Alliance for Responsible Planning
Defenders of Wildlife
Sierra Club
Sweetwater County Wildlife Association
Wyoming Outdoor Council
Wyoming Wildlife Federation
Jackson Hole Area Chamber of Commerce
Jackson Hole Outfitters and Guides Association
Jackson Hole Snow Devils

7.3.4 Others

Wind River Multiple Use Advocates
Rocky Mountain Oil and Gas Association
Linelle S. Wagner
Merrill and Gladys Moulton
William Cochran

Phillip and Etella Hummel
J.B. Jacks
Bradley G. Penn
Phil Hocker
Kent and Lisa Wagener
Wyoming Congressional Delegation
Office of the Governor
Wyoming State Senators and Representatives for Teton and Fremont Counties
Industries and Individuals

7.4 List of Preparers

Table 7-1 lists the principal preparers involved with writing and producing this EIS.

Table 7-1. List of preparers.

NAME	RESPONSIBILITY	QUALIFICATIONS
Bureau of Land Management:		
Bill McMahan	Project Co-Leader	B.S. Wildlife Management; 21 yrs. BLM.
Bob Chase	Geology/Paleontology	Petroleum Engineer 10 yrs. industry; 13 yrs. State Gov.; 7 yrs. MMS/BLM.
Forest Service:		
Al Reuter	Project Co-Leader	AAS Horticulture; B.S. Forestry; M.F. Forestry; 25 yrs. FS.
Consultant Interdisciplinary Team:		
Gary Holsan	Interdisciplinary Team Leader; Project Manager	B.S. Forest and Range Management; 14 yrs. FS; 7 yrs. industry.
Oliver John Grah	Assistant Project Manager; Water Resources; Vegetation, Timber, and Range Resources; Air Quality	B.S. Botany; Postgraduate work in forestry; M.S. Watershed Science; 12 yrs. industry
Miriam Rand	Editor	A.A.S. Journalism; B.S. Biology; 8 yrs. industry.
Robert Harrower	Transportation-Engineering; Health and Safety	B.S. Civil Engineering; M.S. Civil Engineering; 20 yrs. industry.
Steve Daniels	Economics	Ph.D. Economics; 5 yrs. industry.

Table 7-1. continued.

NAME	RESPONSIBILITY	QUALIFICATIONS
William Glenn	Soil Resources	B.S. Agronomy; Post Graduate Work in Soil Science; 6 yrs. FS; 4 yrs. SCS; 18 yrs. industry.
Richard Valdez	Fisheries	B.S. Wildlife Management; M.S. Wildlife Science; Ph.D. Fishery Ecology; 20 yrs. industry.
Larry Hayden-Wing	Wildlife	B.S. Forestry and Wildlife; M.S. Wildlife Management; Ph.D. Wildlife Ecology; 25 yrs. industry.
Richard Krannich	Recreation; Sociology	B.A. Sociology; M.S. Sociology; Ph.D. Sociology; 12 years industry.
Craig Johnson	Visual Resources	B.S. Landscape Architecture; M.S. Landscape Architecture; 23 yrs. industry.
John Senulis	Cultural Resources	B.A. Anthropology; M.A. Anthropology; 25 yrs. industry.

REFERENCES

Ad Hoc Committee, Teton County. 1987. Oil and Gas in Teton County: A Report of the Ad Hoc Committee. Printed by the Jackson Hole Guide.

Ames, D. R. 1978. Physiological responses to auditory stimuli. Pages 23-45 in J.L. Fletcher and R.G Busnel, eds. Effects of Noise on Wildlife. Academic Press, New York.

Banfield, A. W. F. 1971. The relationship of caribou migration behavior to pipeline construction. Pages 797-804 in V. Geist and F. Walther, eds. The behavior of ungulates and its relation to management. I.U.C.N. Publ. New Series No. 24. International Union for Conservation of Nature and Natural Resources, Moreges, Switzerland.

Barry, T. W. and R. Spencer. 1976. Wildlife response to oil well drilling. Can. Wildl. Serv. Progress Note No. 67. 15 p.

Bell, M.C. 1986. Fisheries Handbook of Engineering Requirements and Biological Criteria. Fish Passage Development and Evaluation Program - U.S. Army Corps of Engineers.

Bender, Susan J. 1983. Hunter - Gatherer Subsistence and Settlement in a Mountainous Environment: The Prehistory of the Northern Tetons. State University of New York at Albany, Ph.D. Dissertation.

Berger, T. R. 1977. The Berger Report: Northern Frontier, Northern Homeland. Living Wilderness 41(137):4-33.

Bettinger, Robert L. and M. A. Baumhoff. 1982. The Numic Spread: Great Basin Cultures in Competition, American Antiquity, 47 (3): 485-503.

Bowers, D. 1987. Reclamation Specialist, U.S. Forest Service, Intermountain Station, Forestry Sciences Laboratory, Logan, Utah. Personal Communication with Oliver Grah, BIO/WEST, Inc., Logan Utah.

Bromley, L. 1985. Wildlife management implications of petroleum exploration and development in wildland environments. Gen. Tech. Rep. Int-191. USDA Forest Service, Ogden, Utah, 42pp.

Busnel, R. G. 1978. Introduction. Pages 7-22 in J. L. Fletcher and R. G. Busnell, eds. Effects of Noise on Wildlife. Academic Press, New York.

Calef, G. W., E. A. DeBock, and G. M. Lortie. 1976. The reaction of barren-ground caribou to aircraft. Arctic 29(4):201-212.

Childress, M. 1986. Recreation Staff, Buffalo Ranger District, Bridger-Teton National Forest, Black Rock, Wyoming. Personal Communication with Rick Krannich, Logan, Utah.

Clark, B. 1986. Lodge Manager, Goosewing Ranch. Personal communication with Rick Krannich, Logan, Utah.

Corps of Engineers (COE). 1985. Wetlands Delineation Manual. Technical Report Y-84, Waterways Experiment Station, Vicksburg, Mississippi.

Fanter, J. 1987. Highway Safety Section, Wyoming Highway Department. Personal communication with B. Harrower, Rio Verde, Inc., Pinedale, Wyoming.

Frison, George C. 1975. Archeological Reconnaissance Survey of the Bridger-Teton National Forest, Archeological Report No. 1. Forest Service, Intermountain Region, Ogden, Utah.

Goetz, D. 1986. Commercial snowmobile operator, Jackson, Wyoming. Personal communication with Rick Krannich, Logan, Utah.

Gordon F. 1987. Threatened and Endangered Species Coordinator, Bridger-Teton National Forest, Jackson, Wyoming. Personal communication with Oliver Grah, BIO/WEST, Inc., Logan, Utah.

Harding, L. and J. A. Nagy. 1980. Responses of grizzly bears to hydrocarbon exploration on Richards Island, Northwest Territories, Canada. Pages 277-280 in C. J. Martinka and K. L. McArthur, eds. Bears - Their Biology and Management. The Bear Biol. Assoc.

Harms, D. 1986. Endangered Species Specialist, Endangered Species Field Office, Helena, Montana. Personal communication with Oliver Grah, BIO/WEST, Inc., Logan, Utah.

Helgeson, D. 1986. Lodge Manager, Togwotee Lodge. Personal communication with Rick Krannich, Logan, Utah.

Huddelson, R. 1986. Fisheries Biologist, Wyoming State Game and Fish Department, Jackson, Wyoming. Personal Communication with Laurence Crist, BIO/WEST, Inc.

Huddelson, R. 1987. Fisheries Biologist, Wyoming State Game and Fish Department, Jackson, Wyoming. Personal Communication with Laurence Crist, BIO/WEST, Inc., Logan, Utah.

Jann, G. 1987. Landscape Architect, Bridger-Teton National Forest, Jackson, Wyoming. Personal communication with Craig Johnson, BIO/WEST, Inc., Logan, Utah.

Klein, D. R. 1973. The reaction of some northern mammals to aircraft disturbance. Page 377-383 in XI Int. Cong. Game. Biol., Stockholm, Sweden.

Knight, J. E. 1980. Effect of hydrocarbon development on elk movements and distribution in northern Michigan. Ph.D. Thesis, Univ. of Mich. 79 p.

Leege, T. A. 1984. Guidelines for evaluating and managing summer elk habitat in northern Idaho. Wildlife Bulletin No. 11. Idaho Dept. Fish & Game, Boise. 38 pp.

Lloyd, D. 1986. Hunting Outfitter, Thayne, Wyoming. Personal communication with Rick Krannich, Logan, Utah.

Lockman, D. 1987. Waterfowl Biologist, Wyoming Game and Fish. Personal communication with Larry Hayden-Wing, Hayden-Wing and Associates, Sheridan, Wyoming, February, 1987.

Lockman, D. 1986. Waterfowl Biologist, Wyoming Game and Fish. Personal communication with Larry Hayden-Wing, Hayden-Wing and Associates, Sheridan, Wyoming, March, 1986.

Lowham, H.W. 1976. Technique for estimating flow characteristics of Wyoming streams. Water Resources Investigations 76-112. U.S. Geological Survey in Cooperation with the Wyoming Highway Department.

Lutz, Mrs. K. 1986. Spouse of Hunting Outfitter, Jackson, Wyoming. Personal communication with Rick Krannich, Logan, Utah.

Luz, G. A. and J. B. Smith. 1976. Reactions of pronghorn antelope to helicopter overflight. J. Acoust. Soc. Amer., 59(6):1514-1515.

McDonald, James A. 1983. Cultural Resources Overview: Targhee National Forest, Ms., Targhee National Forest.

McMillan, J. F. 1954. Some observations on moose in Yellowstone Park. Amer. Midl. Nat., 52(2):392-399.

Merritt, L. 1986. Hunting Outfitter, Afton, Wyoming. Personal Communication with Rick Krannich, Logan, Utah.

Miller, F. L. and A. Gunn. 1980. Behavioral responses of muskox herds to simulation of cargo slinging by helicopter, Northwest Territories. Can. Field Nat., 94(1):52-60.

Mourtsen, P. 1986. Recreation Staff, Jackson Ranger District, Bridger-Teton National Forest, Jackson, Wyoming. Personal communication with Rick Krannich, Logan, Utah.

Owens, N. W. 1977. Responses of wintering brant geese to human disturbance. Wildfowl, 28:5-14.

Petroleum Extension Service. 1972. Field Handling of Natural Gas, Third Edition. University of Texas at Austin, Austin, Texas.

Robitaille, R. 1986. President, Petroleum Association of Wyoming. Memo to Teton Oil and Gas Community.

Rodrigues, R. G. and J. Luchetta. 1981. Helicopter mobilization of oil and gas drilling operations in mountainous areas of western Wyoming. U.S. Geological Survey Rept. 81-860. 112 pp.

Schallenberger, A. 1980. Review of oil and gas exploitation impacts on grizzly bears. Bear Biology Assoc. Conf. Ser. 3:271-276.

Senulis, John A. 1969. Aboriginal Exploitation Patterns of the Bear River Drainage, Ms., Department of Anthropology, University of Utah, Salt Lake City.

Steele, R., S.V. Cooper, D.M. Ondov, D.W. Roberts, and R.D. Pfister. 1983. Forest Habitat Types of Eastern Idaho-Western Wyoming. Gen. Tech. Rep. INT-144. USDA Forest Service, Intermountain Forest and Range Experiment Station. 122 pp.

Stuart, B. 1986. Staff Hydrologist, Bridger-Teton National Forest, Jackson, Wyoming. Personal Communication with Oliver Grah, BIO/WEST, Inc., Logan, Utah.

Teselle, R.D., et al. 1985. Oil and Gas Production in the Northern Rockies. American Association of Petroleum Geologists Bulletin.

Thomson, B. R. 1972. Reindeer disturbance. J. Brit. Deer Soc. 2(8):882.

Thune, J. 1986. Hunting Outfitter, Jackson, Wyoming. Personal communication with Rick Krannich, Logan, Utah.

U.S. Department of Interior, Bureau of Land Management (BLM). 1986. Amoco Beartooth Well Exploration Project Environmental Assessment. Bureau of Land Management, Miles City District, Montana.

VerPloeg, Alan J. 1982. Wyoming's Oil and Gas Industry. The Geological Survey of Wyoming, Public Information Circular No. 17, Laramie, Wyoming.

U.S. Army Corp of Engineers (COE). 1985. Wetlands Delineation Manual. Technical Report Y-84, Waterways Experiment Station, Vicksburg, Mississippi.

U.S. Department of Agriculture, Forest Service (FS). 1974. Spread Creek - North Gros Ventre Planning Unit Environmental Statement and Land Use Plan. Bridger-Teton National Forest, Jackson, Wyoming.

U.S. Department of Agriculture, Forest Service (FS). 1980. Fish Creek Grazing Allotment Management Plan. Bridger-Teton National Forest, Jackson, Wyoming. 34 pp.

U.S. Department of Agriculture, Forest Service (FS). 1985a. Gunsight Pass Management Area Timber Sale Environmental Assessment. Jackson Ranger District, Bridger-Teton National Forest, Jackson, Wyoming.

U.S. Department of Agriculture, Forest Service (FS). 1985b. Supplement to the Fish Creek Grazing Allotment Management Plan. Bridger-Teton National Forest, Jackson, Wyoming. 10 pp.

U.S. Department of Agriculture, Forest Service (FS). 1986. Bridger-Teton National Forest Land and Resource Management Plan: Proposed Forest Plan. Bridger-Teton National Forest, Jackson, Wyoming.

U.S. Department of Agriculture, Forest Service (FS). 1987a. Fish Creek C&H annual operating plan. Gros Ventre Ranger District, Bridger-Teton National Forest, Jackson, Wyoming. 5 pp.

U.S. Department of Agriculture, Forest Service (FS). 1987b. Blackrock-Spread Creek C&H annual operating plan. Blackrock Ranger District, Bridger-Teton National Forest, Blackrock, Wyoming. 3 pp.

U.S. Department of Agriculture, Soil Conservation Service (SCS). 1983. Summary of Snow Survey Measurements - Wyoming. Soil Conservation Service, Wyoming State Office, Casper, Wyoming.

U.S. Department of Interior, Bureau of Land Management (BLM). 1976. Alaska natural gas transportation system - final environmental impact statement. Washington, D.C. p. 322-329.

U.S. Department of Interior, Bureau of Land Management (BLM). 1981. Big Sandy/Salt Wills Oil and Gas Environmental Assessment. Bureau of Land Management, Rock Springs District, Wyoming.

U.S. Department of Interior, Bureau of Land Management (BLM). 1985. North Fork Well Final Environmental Impact Statement. Bureau of Land Management, Worland District, Wyoming.

U.S. Energy Information Administration. 1984. Annual Energy Outlook. U.S. Energy Information Administration. Washington, D.C.

Wheller, Robert R. and Maurine Whited. 1981. Oil from Prospect to Pipeline, Fourth Edition, Gulf Publishing Co., Houston, Texas.

Wingerter, T. 1987. Parker Drilling Company, Tulsa, Oklahoma. Letter dated January 9, 1987 to Kent Sauvageau, Amoco, Denver, Colorado.

Wright, Gary A., T. Marceau, F. A. Calabrese & M. Tune. 1978. Greater Yellowstone Cooperative Regional Transportation Study: Regional Assessment Archeological Report, National Park Service, Midwest Archeological Center, Lincoln.

Wright, Gary A., S. Bender and S.Reeve. 1980. High Country Adaptations, Plains Anthropologist, 25 (89): 181-197.

Wyoming Highway Department. 1987. Personal communication with B. Harrower of Rio Verde, Inc., Pinedale, Wyoming.

GLOSSARY

ACCUMULATOR - A vessel or tank used to receive and temporarily store a liquid used in a continuous process in a plant. For example, absorption oil may be stored in an accumulator for a short time before it is returned to the absorber. On a drilling rig, the accumulator stores hydraulic fluid under pressure from compressed nitrogen or air for closing the blowout preventer in an emergency.

ALLOTMENT - An area of land where one or more permittees graze their livestock. Generally consists of public land but may include parcels of private or State lands. The number of livestock and season of use are stipulated for each allotment. An allotment may consist of several pastures or be only one pasture.

ALLUVIUM - A general term for all detrital deposits resulting from the operations of modern rivers, thus including the sediment laid down in riverbeds, floodplains, lakes, fans at the foot of mountain slopes, and estuaries.

ANIMAL UNIT MONTH (AUM) - The amount of forage necessary for the sustenance of a 1,000-lb dry cow in maintenance or gestation or five sheep for 1 month.

AQUIFER - A water-bearing bed or layer of permeable rock, sand, or gravel, capable of yielding water.

BOTTOM HOLE - Refers to the lowest or deepest part of a well.

COATING - A field operation for preparing a pipeline to be lowered into the ditch. The line is coated with an inert material, then spiral-wrapped with a tough, inert wrapper. Machines ride the pipe, and coat and wrap in one continuous operation. This process protects the pipeline from corrosion. For some pipeline jobs the pipe may be coated and wrapped at a mill or construction yard site. Any damage to the coating from transportation or handling can be corrected before the pipe is installed.

COLLUVIUM - A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there cheifly by gravity. Talus and cliff debris are included in such deposits.

COMMUNITY - An aggregate of organisms that form a distinct ecological unit. Such a unity may be defined in terms of plants, animals, or both.

COVER - The material covering the soil and providing protection from, or resistance to, the impact of raindrops and the energy of overland flow, and expressed in percent of the area covered. Composed of vegetation, litter, small rock, and large rocks. These may be lying on or within 20 feet of the ground surface.

CRITICAL WILDLIFE HABITAT - That portion of wildlife habitat that is essential to the survival and perpetuation of threatened and endangered species as designated by the U.S. Fish and Wildlife Service.

CULTURAL RESOURCES - Remains of human activity, occupation, or endeavor, as reflected in sites, buildings, artifacts, ruins, etc.

CUTTINGS - Fragments of rock dislodged by the bit and brought to the surface in the drilling mud.

DEWATERING - The act of removing water.

DIRECTIONAL DRILLING - Although wellbores are normally planned to be drilled vertically, many occasions arise when it is necessary or advantageous to drill at an angle from the vertical. Controlled directional drilling makes it possible to reach subsurface points laterally remote from the point where the bit enters the earth.

DISPERSED RECREATION - Camping in undeveloped sites and informal daytime recreation.

DOGHOUSE - A small house located on the rig floor or nearby and used as an office for the driller and as a storage place for small items.

DRILLING RIG - The derrick, draw-works and attendant surface equipment of a drilling or workover unit.

DRILLING - The operation of boring a hole in the earth, usually for the purpose of finding and removing subsurface formation fluids such as oil and gas.

DRILLING FLUID - The circulating fluid used to bring cuttings out of the wellbore.

ENDANGERED ANIMAL SPECIES - Any animal species in danger of extinction throughout all or a significant portion of its range. This definition excludes species of insects that the Secretary of the Interior determines to be pests and whose protection under the Endangered Species Act of 1973 would present an overwhelming and overriding risk to man.

ENDANGERED PLANT SPECIES - Species of plants in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of the destruction, drastic change, or severe curtailment of habitat, or because of overexploitation, disease, predation, or even unknown reasons. Plant taxa from very limited areas (e.g. the type localities only), or from restricted fragile habitats usually are considered endangered.

EPHEMERAL STREAM - A stream that flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice and which has a channel bottom that is always above the local water table.

FIELD - A geographical area in which a number of oil or gas wells produce from a continuous reservoir. The term generally refers to the surface area, although at times it may refer to both the surface and the underground productive formations. In a single field there may be several separate reservoirs at varying depths.

FLARE - An arrangement of piping and a burner to dispose of surplus combustible vapors, usually situated around a gasoline plant, refinery, or producing well.

FLOODPLAIN - The flat ground along a stream covered by water at the flood stage.

FORAGE - Vegetation of all forms available for animal consumption.

FORB - A broad-leafed flowering herb other than grass

FUGITIVE DUST - Airborne particulate matter composed of soil resulting from industrial activity.

HABITAT - A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

HYDROCARBONS - Organic compounds of hydrogen and carbon, whose densities, boiling points, and freezing points increase as their molecular weights increase. Although composed only of carbon and hydrogen, hydrocarbons exist in a great variety of compounds, owing to the strong affinity of the carbon atom for other atoms and for itself. The smallest molecules are gaseous; the largest are solids. Petroleum is a mixture of many different hydrocarbons.

IMPACT - The results of an action on the environment; the impact may be primary (direct) or secondary (indirect).

INTERMITTENT STREAM - A stream or reach of a stream that drains a watershed of at least one square mile; or a stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground-water discharge.

INVERTEBRATE - Any animal that lacks a backbone.

LARVAE - An insect in its earliest stage of development, after it has hatched and before it is changed into a pupae.

MESIC - Characterized by, related to, or requiring a moderate amount of moisture.

MITIGATION - The abatement or reduction of an impact to the environment by 1) avoiding a certain action or parts of an action, 2) employing certain construction measures to limit the degree of impact, 3) restoring an area to preconstruction conditions, 4) preserving or maintaining an area throughout the life of a project, or 5) replacing or providing substitute resources to the environment.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) - The federal law, going into effect on January 1, 1970, that 1) established a national policy for the environment, 2) requires federal agencies to become aware of the environmental ramifications of their proposed actions, 3) requires full disclosure to the public of proposed federal actions and a mechanism for public input into the federal decision-making process, and 4) requires federal agencies to prepare an environmental impact statement for every major action that would significantly affect the quality of the human environment.

NATIONAL REGISTER OF HISTORIC PLACES - A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

OFF-ROAD VEHICLE (ORV) - A vehicle (including four-wheel drive, trail bikes, and snowmobiles but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling off-road over land, water, ice, snow, sand, marshes, and other terrain.

OROGRAPHIC - Of or related to mountains; associated with or induced by the presence of mountains.

PERENNIAL STREAM - A stream or part of a stream that flows continuously during all of the calender year as a result of groundwater discharge or surface runoff.

PERMEABILITY - Extent that a substance is open to passage or penetration, especially by fluids.

PLUG - Any object or device that serves to block a hole or passageway, as a cement plug in a borehole.

PRECIPITATION - As used in hydrology, precipitation is the discharge of water, in liquid or solid state, out of the atmosphere, generally upon a land or water surface.

RAPTOR - Living on prey; a group of carnivorous birds consisting of hawks, eagles, falcons, vultures, and owls.

RECREATION RESOURCES - Formally designated areas and informal dispersed areas that are managed by federal, state and local agencies in order to preserve and further their use for play, amusement, or relaxation.

RESERVE PIT - Mud pit in which a reserve supply of drilling fluid is stored. Now the "reserve pit" is actually used as a waste pit.

RIGGING UP - Before the work of drilling can be started, but after the derrick has been built, tools and machinery must be installed. This operation, which in substance is that of getting the rig ready, is conveniently described by the driller's term "rigging up."

RIPARIAN - Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow along or around springs.

RIP RAP - A foundation or erosion control devise consisting of rocks thrown together without order.

SCOPING - An early and open process for determining the scope of issues to be addressed in an EIS and for identifying the significant issues related to a proposed action. Scoping may involve public meetings, field interviews with representatives of agencies and interest groups, discussions with resource specialists and managers, and written comments in response to news releases, direct mailings, and articles about the proposed action and scoping meetings.

SEDIMENT - Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water, or on land.

SEISMIC - Pertaining to an earthquake or earth vibration, including those that are artificially induced.

SENSITIVE - Species not yet officially listed as rare under the Rare and Endangered Species Act but which are undergoing a status review or are proposed for listing according to Federal Register notices published by the Secretary of the Interior or the Secretary of Commerce or according to comparable state documents published by state officials.

SIGNIFICANT IMPACT - A meaningful standard to which an action may impact the environment. The impact may be beneficial, adverse, direct, indirect, or cumulative, and may have short-term or long-term effects.

SILT - Any earthy material composed of fine particles, smaller than sand but larger than clay, suspended in or deposited by water.

SPECIES - 1) The classification level of biological nomenclature which categorized each group of related organisms potentially capable of interbreeding; 2) the accepted level of classification to differentiate one specific type of organism from another.

STIPULATION - A legal requirement.

THREATENED ANIMAL SPECIES - Any animal species likely to become endangered within the foreseeable future throughout all or a significant part of its range.

THREATENED PLANT SPECIES - Species of plants that are likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges, including species categorized as rare, very rare, or depleted.

TOESLOPE - The most distal part of a landslide; the downslope edge of a landslide or slump.

TOPOGRAPHY - The features of the earth, including relief, vegetation, and waters.

TOPSOIL - The uppermost layers of naturally occuring soils suitable for use as a plant growth medium.

VEGETATION - Plants in general or the sum total of the plant life above and below ground in an area.

VENT - An opening in a vessel, line, or pump to permit the escape of air or gas.

VERTEBRATE - Animals that have backbones.

VISUAL QUALITY OBJECTIVE, FS - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

VISUAL RESOURCE MANAGEMENT CLASS, BLM - The degree of visual change that is acceptable within the characteristic landscape. It is based upon the physical and sociological characteristics of any given homogeneous area and serves as a management objective.

VISUAL RESOURCES - Visible features of the landscape including land, water, vegetation, and animals.

VISUAL SENSITIVITY LEVELS - An index of the relative degree of user interest in scenic quality and concern and attitude for existing or proposed changes in the landscape features of an area in relation to other areas in the planning unit.

WELLBORE - The hole made by the drilling bit.

WELLHEAD - The equipment used to maintain surface control of a well. It is formed of the casing head, tubing head, and Christmas tree. Also refers to various parameters as they exist at the wellhead, such as wellhead pressure, wellhead price of oil, etc.

WILDLIFE - All species of mammals, birds, fish, amphibians, and reptiles found in a wild state.

WILDLIFE HABITAT - All elements of a wild animal's environment necessary for completion of its life cycle. These elements include food, cover, water, and living space.

ABBREVIATIONS

ACEC	Areas of Critical Environmental Concern
ANSI	American National Standards Institute
APD	Application for Permit to Drill
API	American Petroleum Institute
ATV	All-Terrain Vehicle
AUM	Animal Unit Month
BLM	Bureau of Land Management
C&H	Cattle and Horse Grazing Allotment
CEQ	Council for Environmental Quality
COE	Army Corp of Engineers
DEQ	Department of Environmental Quality
EA	Environmental Assessment
EIS	Environmental Impact Statement
FP	Forest Plan
FS	Forest Service
HRU	Human Resource Unit
MP	Management Prescription
NACE	National Association of Corrosion Engineers
NEPA	National Environmental Policy Act
NOS	Notice of Staking
OSHA	Occupational Safety and Health Administration
PSD	Prevention of Significant Deterioration Standards
RIM	Recreation Information Management
ROS	Recreation Opportunity Spectrum
RPA	Renewable Resources Planning Act
RVD	Recreation Visitor Day
SCS	Soil Conservation Service
USDA	United States Department of Agriculture
VQL	Visual Quality Level

APPENDIX A

Field Development
Sohare Creek Federal Exploration Unit

APPENDIX A

FIELD DEVELOPMENT

SOHARE CREEK FEDERAL EXPLORATORY UNIT

TABLE OF CONTENTS

Introduction A-1

Discovery Probability A-2

Well Development A-3
Development for Oil A-4
Development for Gas A-4

Field Development A-5
Field Development Plan A-5
Special Stipulations A-5
General Field Development A-6
Modeled Field Development A-8
Typical Field Development Scenario A-9

Environmental Review A-9

Bibliography A-11

LIST OF FIGURES

A-1 Amoco Sohare Creek Unit A-12
A-2 Slope, Active Landslides A-13
A-3 Grizzly Bear Habitat A-14
A-4 Elk Habitat A-14
A-5 Moose Habitat A-16
A-6 Antelope Habitat A-17

APPENDIX A

FIELD DEVELOPMENT

SOHARE CREEK FEDERAL EXPLORATORY UNIT

INTRODUCTION

As previously noted in the Chapter 1 of the EIS, Amoco is seeking federal and state approvals for the drilling, production testing, and production operations of a single exploratory oil well. The Bureau of Land Management (BLM) and the Forest Service's (FS) environmental review and decision-making process for the Amoco proposal applies only to exploration and production from the single well as specified in Amoco's Application for a Permit to Drill (APD), which describes their drilling and surface use programs.

The potential cumulative effects of additional exploration wells, future production wells, and associated production facilities were identified as important public concerns during the scoping process for this EIS. Public responses included such statements as:

- "We should not be allowing leasing or exploratory drilling if the environment cannot afford the impacts of a field development."
- "Full field analysis should occur at the time of lease, but if it is not done then, at least before any exploration is approved."
- "It is too early to address field development at the exploration stage. Exploratory drilling should be allowed. If a discovery is made, assess the well's production potential, and then address field development."

It should be recognized that the potential cumulative effects of field development includes two distinctly separable components: magnitude and likelihood. **Magnitude** is a measure of the potential number of additional wells and facilities. **Likelihood** is a measure of the probability of encountering producible quantities of oil and gas. Thus, viewing impacts in terms of only one of these two components does not accurately describe the whole picture. Both components need to be taken into account in the impact analysis.

This Appendix provides a brief discussion of the possibilities and associated limitations for future development proposals that could occur if the exploratory drilling program is successful in discovering commercial quantities of oil. Additional discussion

and environmental analyses of leasing public lands for oil and gas development are provided in the Forest Plan DEIS published in October 1986. In addition, the draft Bridger-Teton National Forest Plan includes coordination requirements relative to other resources, i.e., wildlife, soils, water, etc. A description of oil and gas leasing and development and the associated environmental effects for the Bridger-Teton National Forest is in the minerals and energy sections of these documents. Also, further discussion of oil and gas development and field development is available in the Teton County Oil and Gas Committee report entitled, "Oil and Gas In Teton County: A Report of the Ad Hoc Committee". This report was published in February 1987, and was widely distributed. The FS and the BLM participated as members of the Committee and both agencies consider this report to represent the best assessment of current knowledge and information available.

DISCOVERY PROBABILITY

Amoco's Sohare Creek Unit is a federal exploratory unit encompassing a logical but unproven geologic area of 18,429.52 acres. The unit is currently nonproductive and Amoco's efforts are to find and prove the existence of commercial deposits of oil. Amoco's primary objective, as is that of the other oil and gas companies involved within Teton County, is to find oil. This is because there is presently a glut of natural gas on the market. Gas production would be considered only if there was a major discovery. The volume, quality and price considerations would be factors that Amoco would consider in determining whether a gas discovery was "major" or not. EXXON Company U.S.A.'s 1981 Kettle Creek well discovery of 574,000 cubic feet of gas per day was not a "major discovery".

Amoco's proposed Sohare Creek Exploration Well is classified as a wildcat well since it would be drilled in the unproven territory of the Sohare Creek Exploratory Federal Unit. Three previous wells were drilled inside this Unit, one of which showed marginal quantities of gas (Exhibit A-1). Nationally, during the years 1980-1984, approximately 28 percent of all exploratory wells successfully encountered oil or gas (U.S. Energy Information Administration 1984); during the same period, the success rate in Wyoming has been approximately 19.6 percent, and for the period of 1970 to 1980, approximately 17.4 percent. (TeSelle 1985; VerPloeg 1982).

In Teton County, 44 wells have been drilled since the first well in the county was approved on April 24, 1947. Two of the 44 wells showed marginal hydrocarbons.

If oil is discovered, further exploration would be dependent upon the geologic data gained and the economic attractiveness of proposing additional wells in the unit. If oil is discovered,

the size of the unit is likely to contract, reducing the total acreage in the unit. The number of wells needed to efficiently produce the unit would also be reduced as the actual producible reservoir is more precisely defined.

Estimates of the potential number of wells could be made based on an assumption that the Sohare Creek Unit would contract similar to the units considered in the Teton County Oil and Gas Committee Report. It should be recognized that such estimates reflect only an estimate of magnitude, in terms of the number of wells, and not a measure of likelihood of encountering production. The environmental, social, and economic consequences of field development would depend on the extent, location, duration, and timing of development activities.

There is a high probability that the proposed Sohare Creek exploration well would not discover commercial hydrocarbons. None of the previous 44 wells drilled in Teton County discovered oil in commercial quantities. Many of these wells, however, were drilled to shallower depths. Improvements in seismic technology have increased the predictive capability of a discovery.

The question is often asked "Why put up with the impacts and costs if the probability is so low?". The high cost of exploration is a factor that industry must justify to themselves. Included in this is the added cost of more sophisticated construction and reclamation requirements because of the sensitive resource values involved. These costs and the impacts associated with exploration are justified and rationalized in the minds of industry and the American public as a whole on the basis of the continued high demand for oil and gas. Hydrocarbon shows in the 1981 EXXON drilling and the results of the recent seismic survey by Amoco further justifies, in their opinion, the cost and risk of continued exploration. The impacts of field development would be addressed in an environmental analysis and a decision made by the Federal Agencies commensurate with the environmental risk. Since it is impossible to anticipate if or exactly how the area would be developed, the discussion of field development is general and is based on past oil development in the seven-county area in and around the Bridger-Teton National Forest.

WELL DEVELOPMENT

In 1981, the EXXON Kettle Creek well (approximately 1.5 miles northwest of the proposed Amoco well), which was drilled to the Madison Formation, found gas in non-commercial quantities (574,000 cubic feet of gas per day). On the basis of this information, Amoco's well, which would also be drilled to the Madison, could encounter either gas or oil.

As described in Chapter 1 of this EIS, Amoco would drill the Sohare Creek exploration well to determine the occurrence of

hydrocarbon reserves, and evaluate the commercial potential of the well by conducting various tests. These include analyzing drill hole cutting samples to detect evidence of oil; drill stem tests to determine more closely the performance of the reservoir's productive capacity; and electrical log surveys to determine reservoir porosity and presence of oil or gas. Depending on the outcome of the testing program, Amoco may choose to: permanently plug the well and abandon the location; temporarily plug or shut-in the well until decisions are reached regarding future production options; or proceed with installation of on-site production equipment.

Development for Oil - If the well is determined to be an oil producer, several steps would be taken to complete or develop the well. These steps usually include the following actions: install and cement casing; perforate reservoir; install production tubing; install control heads (an assembly of valves and gauges called a "Christmas Tree") to control the rate of flow on flowing wells, or install a pumping unit in a nonflowing well to lift oil to the surface; erect a battery of tanks (usually two) for storing the oil; install a separator tower if oil has a high gas content to separate the gas from the oil; and if oil is contaminated with water, treat oil chemically or install a heater to remove water so that the oil meets pipeline requirements.

Development for Gas - Because of the close interrelationships of gas and oil in nature and because much of the gas production today is associated gas produced with oil, natural gas production is influenced by the above oil well development and production practices. However, there are certain features of gas fields that are specific to gas production. Reservoir pressure is the controlling factor in the ability of a well to produce. Estimating the reserves, forecasting production rates, and production life are early considerations in determining the economic feasibility of gas well completion and development. Completion of a gas well includes steps comparable to that for an oil well. Casing, tubing, and well head equipment are selected on the basis of flow rates, fluid erosion, and chemical corrosion. Safety shutoff equipment is more critical and must meet higher design standards; compressors may be needed to help produce the well if the producing pressure at the surface is less than pipeline pressure. Safety and flow regulator valves ("Christmas Tree") are installed at the well head. The equipment and fittings must meet standards set by the American Petroleum Institute (API) following sizes and ratings established by the American National Standards Institute (ANSI) if corrosive conditions are expected.

In summary, the above-ground production facilities of an oil well versus a gas well can be compared as follows:

Oil Well	Gas Well
Christmas Tree	Christmas Tree
Pumping Equipment	Compressor
Storage Tanks (Two)	Dehydration Unit
Gas Separator	
Heater Treater	

These facilities would be installed on approximately one-third of the existing well pad and maintained throughout the productive life of the well. The balance of the well pad would be recontoured and revegetated to as near its original condition as possible.

If the Sohare Creek exploration well is successful, Amoco's plans for production would be communicated to the BLM and FS in the form of a Sundry Notice Application. Both agencies would review the application to assure compliance with lease/unit stipulations, mitigating measures in the Amoco Sohare EIS, and applicable laws and regulations. Supplemental environmental analyses would be required if the single well EIS does not adequately cover the anticipated environmental impacts of production from the single well.

FIELD DEVELOPMENT

Field Development Plan - Discovery of commercially viable oil reserves could lead to additional proposals for oil development in the Sohare Creek Unit. As operator of the unit, Amoco is responsible (Section 10 of the Unit Agreement) for preparing a Field Development Plan and submitting it to the BLM and FS for approval. The Field Development Plan would be based on findings of the Sohare Creek exploration well and would be restricted to specific activities or facilities needed to further explore, or produce hydrocarbon products from the Sohare Creek Unit. The exploratory Unit includes several federal oil and gas leases which, based on geologic evidence, probably comprise the same potential oil and gas reservoir(s). Although the unit leases are held by several companies and individuals, the unit agreement assures that all development and production activities would be coordinated.

Special Stipulations - A Field Development Plan within the Sohare Creek Federal Exploratory Unit would be governed by the terms of the federal lease/unit agreement. The federal lease/unit agreement terms include special stipulations which would be applied to several of the federal leases and the unit as appropriate (see EIS Appendix B). These stipulations would

influence the design of field development plans. In particular, the No Surface Occupancy (NSO) stipulation, the Jackson Hole Stipulations, and the Conditional No Surface Occupancy (CNSO) stipulation would limit and control surface developments. These stipulations are intended to protect sensitive resource values (Exhibits A-2 through A-6).

Specific lease and unit stipulations that would limit and/or control surface development are as follows:

NAME OF STIPULATION 1	ENVIRONMENTAL/RESOURCE CONCERN	ACRES/MILES
Jackson Hole Stipulation	Range of Development	18,429.52 ac
Special Values Stipulation	Elk Migration	7.25 mi
Special Values Stipulation	Big Game Winter Range	7,120.00 ac
Special Values Stipulation	Elk Calving	1,250.00 ac
Special Values Stipulation	Big Game Summer Range	5,320.00 ac
Threatened and/or Endangered Special Stipulation	Grizzly Bear	4,320.00 ac
Conditional No Surface Occupancy Stipulation	Technically Unsuitable Soils	930.00 ac
No Surface Occupancy Stipulation	Slopes Greater Than 40%	8,210.00 ac
No Surface Occupancy Stipulation	Gunsight Pass Repeater Station	5.00 ac

1/ See Appendix B for stipulation language.

The NSO stipulations on 40 percent slopes and the Gunsight Pass Repeater Station, and the CNSO stipulation for technically unsuited soils restricts occupancy in many areas of the unit. Exceptions to these lease and unit agreement stipulations can be approved only if, after the preparation of an environmental analysis, an acceptable plan for mitigation is agreed upon between the federal agencies and Amoco. It is necessary for the environmental document to specifically consider any change or modification of the stipulation(s) along with the alternative of not approving such change or modification.

General Field Development - Specific proposals for future oil development would be based on Amoco's evaluation of the drilling and production testing programs currently proposed. In a general sense, full development of the Unit would involve construction, operation, and abandonment of facilities needed to efficiently produce, process, and transport the hydrocarbon reservoirs within the proposed Unit area. Specific components which would be included in a Field Development Plan for the Sohare Creek Unit include the following:

- Confirmation Well. An additional exploration well could be required to further evaluate and confirm the hydrocarbon potential of the Unit. A confirmation well would involve a program similar to that currently proposed by Amoco, but in a different location within the field. Its location would depend on the characteristics of the reservoir discovered and the surface resource protection needs.

- Production Wells. Oil and/or gas fields generally require more than one well to efficiently drain the hydrocarbon reservoirs. Well density and location are designed to efficiently produce the natural resource, based on specific reservoir characteristics, economics, and environmental considerations such as those addressed by the NSO, CNSO, and Jackson Hole Stipulation. Most of the information required to determine appropriate well density and locations is not available until after the reservoir has been penetrated and production characteristics have been established. Within the Sohare Creek Federal Exploratory Unit, the ultimate well density would be decided only after a discovery of hydrocarbons. The well density proposed at that time, after considering all pertinent information, would be subject to the approval of the State of Wyoming Oil and Gas Conservation Commission, and the BLM and FS.

- Roads. A road system would be designed and constructed so that equipment could be brought to each well site. Road standards would be dictated by the amount of traffic, safety considerations, and environmental concerns. Existing roads (i.e., the Gros Ventre, Cottonwood Creek, Gunsight Pass, and Flagstaff) would be upgraded wherever possible. The road system would be maintained and remain in place until production ceases and the abandoned well site(s) reclaimed.

- Production Transport. A system for transporting the oil and/or gas to central storage and treatment facilities would be designed. This could mean construction of a pipeline system, or trucking, or a combination of the two.

- Electrical Power Distribution. Electric power would be needed to operate and monitor production equipment. The traditional method of distributing electric power is through the use of power lines. Technological advancements, however, now make it possible to bury lines up to and including 33kV.

The location, size, and design of these potential facilities cannot be described without additional information on the characteristics of the hydrocarbon reservoirs that may exist within the Unit. As previously stated, the purpose of the exploration well currently under consideration is to determine the existence and characteristics of potential hydrocarbon

reservoirs. If additional facilities are proposed, they would be subject to further environmental review, as outlined below under "Environmental Review".

Modeled Field Development - Representatives of the BLM, Rock Spring District and the FS, Bridger-Teton National Forest participated as members on the Teton County Oil and Gas Committee. The BLM and the FS consider the Teton County Ad Hoc Committee's Report (February 1987) to represent the best available information for estimating the likelihood and magnitude of oil and gas development in four existing oil and gas units within Teton County, one of which is the Sohare Creek Unit. However, while it serves as a basis for describing potential field development, it was not intended to be a site-specific impact prediction.

Dr. J. David Love's (U.S. Geological Survey) assessment of the potential for oil and gas within Teton County is quoted in the Committee's report as saying, "There is modest oil and gas potential in Teton County." This was based on his evaluation of what are considered to be the requisites for good oil and gas development prospects; i.e., source rocks, reservoir rocks, and trapping formation. In estimating the magnitude of field development, the Committee developed "typical development scenarios(s)" based on data compiled on 60 units in western Wyoming dating back to 1973.

The Committee concluded that because of significant information deficiencies (e.g., no commercial discoveries) within Teton County, field development scenarios would be limited to an average of what took place in western Wyoming since 1973.

In consideration of the above, the following assumptions were identified by the Committee and applied to the model for field development:

1) Discovery unit area will be reduced (contracted) to about 18 percent of original size if production begins.

2) Each well site is set up on 346-acre spacing, or about two wells per section.

3) Each well head would require 3.5 acres of clearing. Pipeline corridors will be cleared to 50 feet wide.

4) Roads on slopes exceeding 40 percent or those crossing unstable soils will be difficult or impossible to completely reclaim.

5) The model considers only oil development. Gas development would be less intensive.

Typical Field Development Scenario - The best description of what field development may entail for the Sohare Creek Unit has been developed by the Teton County Oil and Gas Committee with active participation by the BLM and Bridger-Teton National Forest. A description of that typical development scenario, as excerpted in part from the Committee's report follows. We believe this scenario to be based on the best available information over a broad area, and therefore represents a reasonable but speculative scenario.

Sohare Unit (Mt. Leidy Highlands)

Model Description: The original unit of 18,560 acres is contracted to 3,317 acres after oil is discovered. Ten wells are developed. Oil is pumped north to Black Rock via a pipeline running along the south fork of Spread Creek and is stored at a loading site near the highway where it is transferred to tank trucks and hauled to Riverton. The impact of the pipeline corridor is not included in the model. Access roads to the field remain in place for the life of the field, but are closed to the public. Maintenance workers use the roads several times each day and reach the well sites in a tracked snow vehicle during heavy snows. At other times, the access roads are plowed.

Twelve miles of new roads are required, with the Hatchet Road from Black Rock to the south fork of Spread Creek remaining open most of the year. The development also requires clearing 35 acres for the 10 well sites as well as an undetermined amount of clearing for the transfer pipeline corridor. Much of the pipeline will parallel existing roads.

ENVIRONMENTAL REVIEW

If commercial quantities of hydrocarbons are discovered, BLM and FS regulations, and the terms of the Sohare Creek Federal Exploratory Unit Agreement require that a conceptual Field Development Plan be prepared. The Field Development Plan would describe the extent, location, duration, and timing of additional wells and other facilities required for full field development. As operator of the Sohare Creek Federal Exploratory Unit, Amoco would formulate the conceptual development plan for submittal to BLM, FS, and other federal and state agencies. As indicated on Exhibits A-2 to A-6 and in Chapter 3 of the DEIS, sensitive resource values exist throughout the unit. These include active landslide areas, slopes in excess of 40 percent, grizzly bear habitat, elk migration corridors, winter range for wildlife and calving areas for big game. The potential impacts of oil and gas development on these sensitive values must be thoroughly analyzed and documented in an environmental analysis. Approval must conform and be consistent with Federal and State laws and

regulations. Any oil and gas development in the area would require a thorough analysis and recognition that there are resource conflicts. Mitigation measures can lessen and sometimes avoid these impacts but cannot resolve every resource conflict.

As part of the federal technical and environmental review process, proposals for further oil and gas development in the Sohare Creek Federal Exploratory Unit would be subject to environmental analysis requirements of the National Environmental Policy Act (NEPA) and the implementing regulations of the Council on Environmental Quality. Thus, once a conceptual development plan is submitted by Amoco, BLM and the FS would complete an analysis of all aspects of the field development proposal, and prepare the appropriate environmental document (either an EA or an EIS). Rationale for denial of activity, comparable to those analyzed under the No Action Alternative, would provide constraints under which further activity could be limited. Legislative action could deny further activity upon the lease. See Chapter 2, Alternative E for further explanation.

As required by NEPA, the environmental review would include a formal process for identifying public and agency concerns regarding the proposal. The environmental analysis would specifically address the potential environmental impacts of the proposal and its alternatives. It would be distributed for public, state, and federal agency review and comment. All comments received would be considered in the BLM and FS decision-making process.

Any proposed field development activities in the Sohare Creek Federal Exploratory Unit would also be subject to the permitting processes of the State of Wyoming. Depending on the nature and extent of the conceptual development plan, field development activities may require additional or concurrent state environmental review under rules applicable in Wyoming. All Federal and State requirements would be coordinated.

BIBLIOGRAPHY

Ad Hoc Committee, Teton County. 1987. Oil and Gas in Teton County: A Report of the Ad Hoc Committee. Printed by the Jackson Hole Guide, Jackson, Wyoming.

Bureau of Land Management. 1981. Big Sandy/Salt Wells Oil and Gas Environmental Assessment. USDI, Bureau of Land Management, Rock Springs District, Wyoming.

Bureau of Land Management. 1985. North Fork Well Final Environmental Impact Statement. USDI, Bureau of Land Management, Worland District, Wyoming; USDA, Forest Service, Shoshone National Forest, Wyoming.

Bureau of Land Management. 1986. Amoco Beartooth Well Exploration Project Environmental Assessment. USDI, Bureau of Land Management, Miles City District, Montana.

Petroleum Extension Service, University of Texas at Austin. 1972. Field Handling of Natural Gas. Third Edition. University of Texas at Austin.

Teselle, R.D., et al. 1985. Oil and Gas Production in the Northern Rockies. American Association of Petroleum Geologists Bulletin.

U.S. Energy Information Administration. 1984. Annual Energy Outlook. U.S. Energy Information Administration, Washington, D.C.

VerPloeg, Alan J. 1982. Wyoming's Oil and Gas Industry. The Geological Survey of Wyoming, Public Information Circular No. 17, Laramie, Wyoming.

Wheeler, Robert R. and Maurine Whited. 1981. Oil from Prospect to Pipeline. Fourth Edition. Gulf Publishing CO., Houston, Texas.

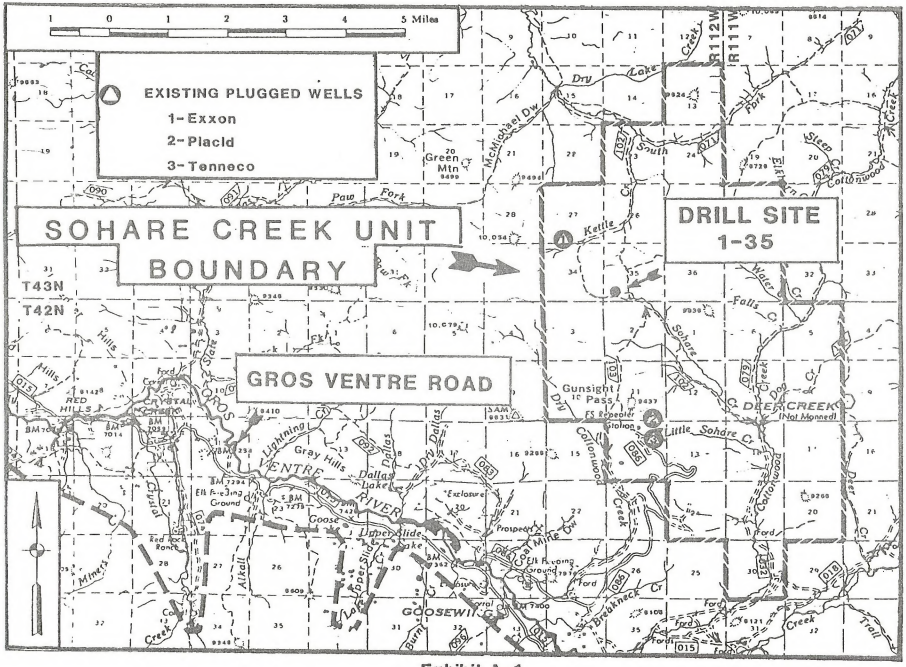
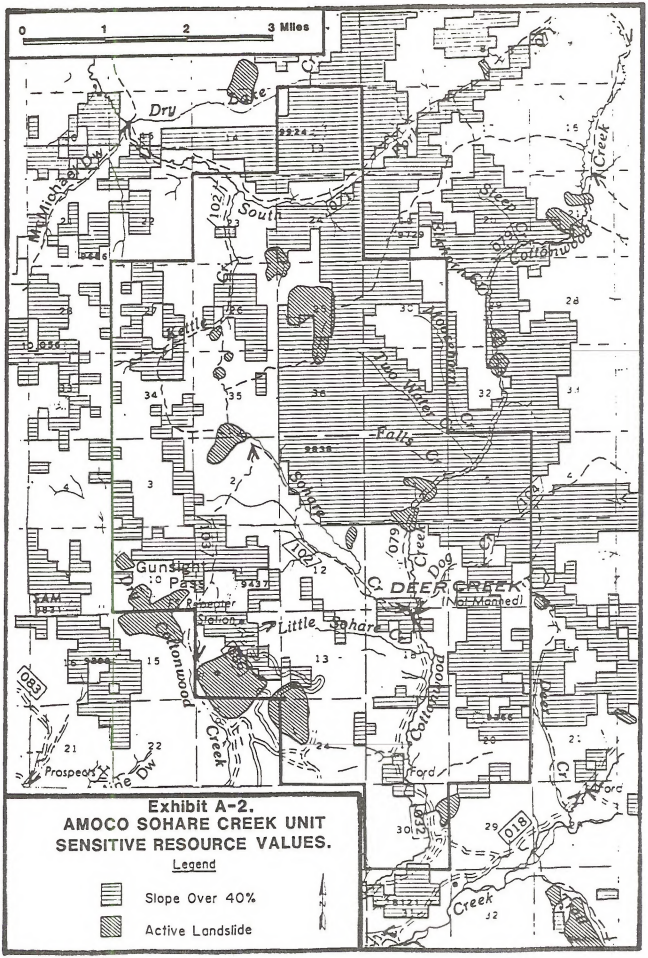
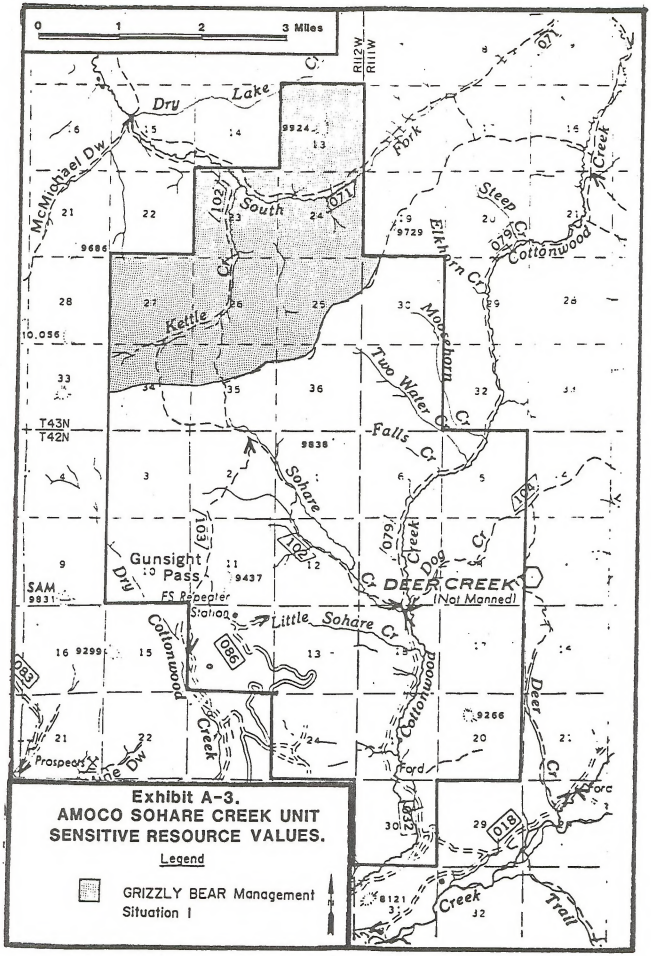
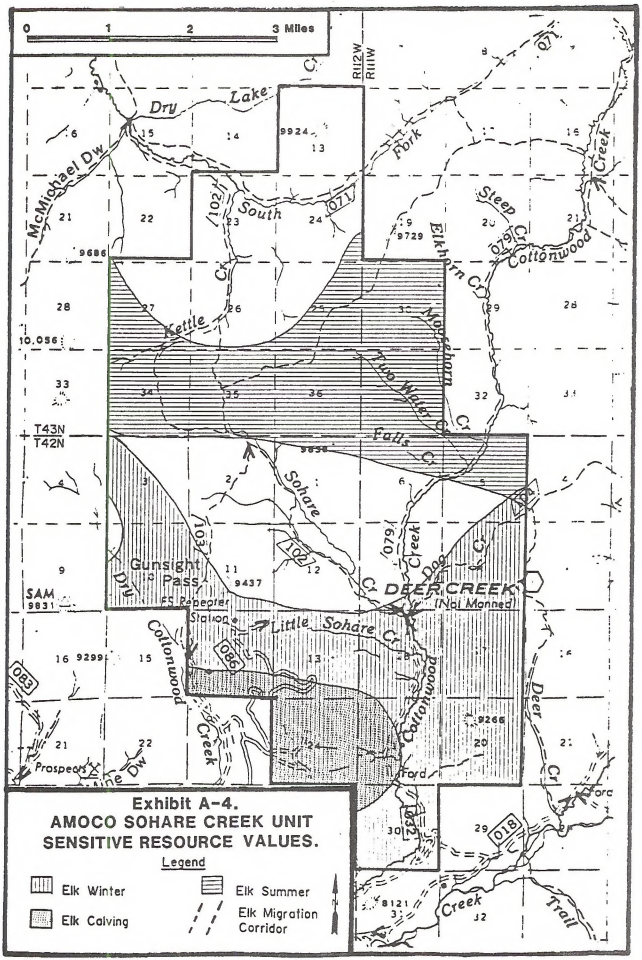
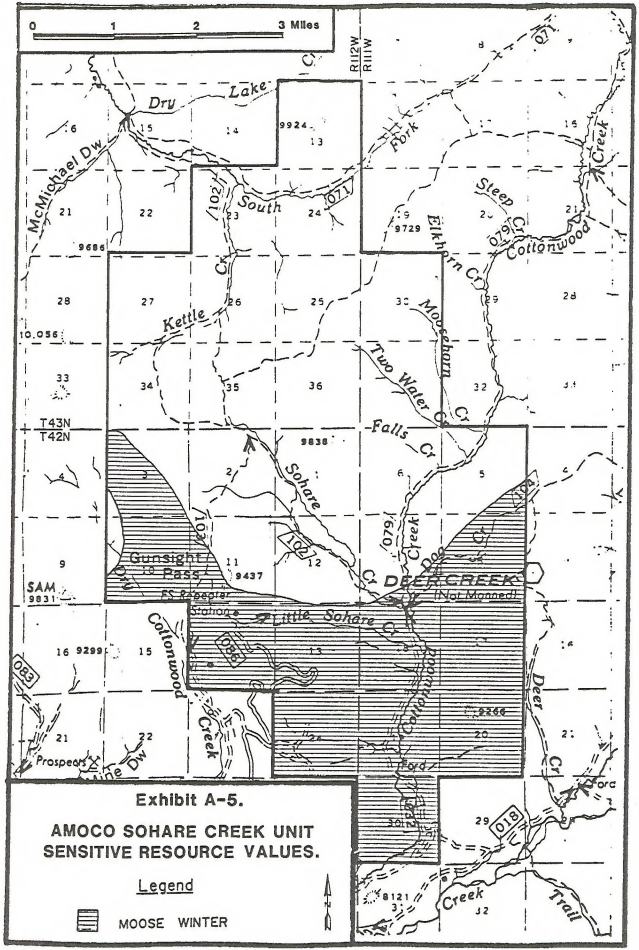


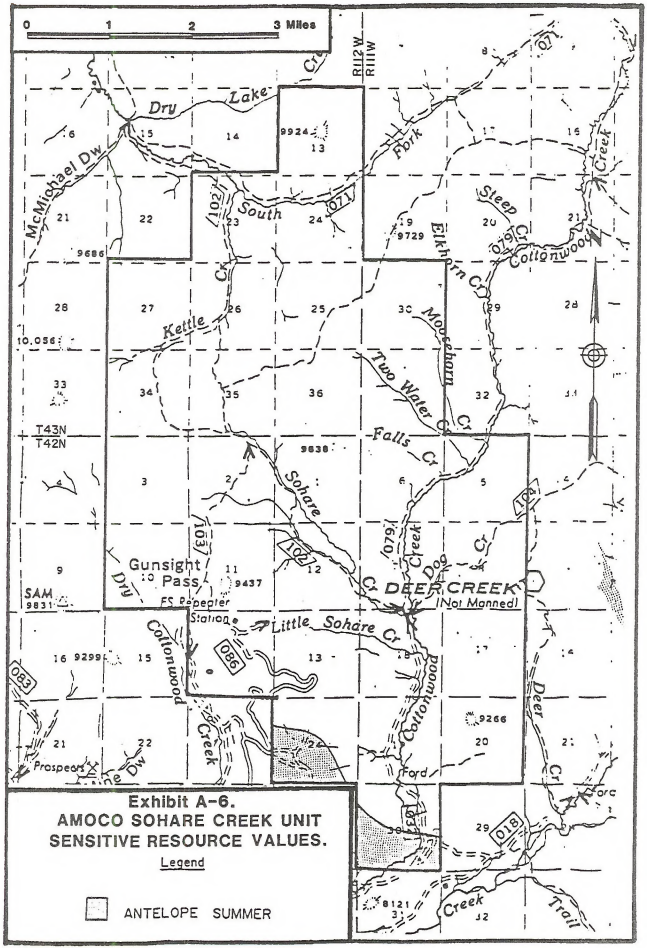
Exhibit A-1.
AMOCO SOHARE CREEK UNIT MAP.


0 1 2 3 Miles
Dry
Duke
South
Fork
Steep
Cottonwood
Creek
Kettle
Two Water Cr.
Falls Cr.
Sohare
Creek
Dog
Cr.
DEER CREEK
(Not Manned)
Gunsight
Pass
Ranger
Station
Little Sohare
Cottonwood
Creek
Prospect
Ford
Creek
Exhibit A-2.
AMOCO SOHARE CREEK UNIT
SENSITIVE RESOURCE VALUES.
Legend
Slope Over 40%
Active Landslide


0 1 2 3 Miles
R11W
R12W
Dry Lake
McMichael Dw
South Fork
Steep Creek
Elkhorn Cr
Cottonwood Cr
Kettle Cr
Moosehorn Cr
Two Water Cr
Falls Cr
Sohare Creek
Dry Creek
Gunsight Pass
FS Repeater Station
DEER CREEK (Not Manned)
Little Sohare Cr
Cottonwood Creek
Deer Cr
Prospect Ck Dw
Ford
Trail
T43N
T42N
SAM 9831
9686
10,056
9838
9437
9299
9224
9729
9266
8121
102
101
079
086
083
018
Exhibit A-3.
AMOCO SOHARE CREEK UNIT
SENSITIVE RESOURCE VALUES.
Legend
GRIZZLY BEAR Management Situation 1
N


0 1 2 3 Miles
R11W
R12W
Dry Lake
McMichael Dw
South Fork
Steep Cr
Cottonwood Cr
Elkhorn Cr
Kettle Cr
Meadhorn Cr
Two Water Cr
Falls Cr
T43N
T42N
Sohare Cr
Gunsight Pass
Repeater Station
Little Sohare Cr
Deer Creek
(Not Manned)
Dog Cr
Cottonwood Creek
Deer Cr
Prospect
Ford
Trail
Exhibit A-4.
AMOCO SOHARE CREEK UNIT
SENSITIVE RESOURCE VALUES.
Legend
Elk Winter
Elk Calving
Elk Summer
Elk Migration Corridor


0 1 2 3 Miles
R112W
R111W
Dry Lake
McMichael Dw
South Fork
Sheep Creek
Elkhorn Cr
Cottonwood Creek
Kettle Cr
Moosehorn Cr
Two Water Cr
Falls Cr
Sohare Creek
Gunsight Pass
SAM 9831
FS Ranger Station
DEER CREEK (Not Manned)
Little Sohare Cr
Cottonwood Creek
Deer Cr
Prospect Ridge Dw
Ford
Trail
T43N
T42N
9924
9729
9686
10,056
9838
9437
9299
9266
8121
Exhibit A-5.
AMOCO SOHARE CREEK UNIT
SENSITIVE RESOURCE VALUES.
Legend
MOOSE WINTER


0 1 2 3 Miles
R11W
R11W
Dry Lake
McMichael Dw
South Fork
Sleep Creek
Elkhorn Cr
Cottonwood
Kettle Cr
Mosehorn Cr
Two Water Cr
Falls Cr
Sohare Creek
Dog Cr
Gunsight Pass
Dry Cr
SAM 9831
FS Repeater Station
DEER CREEK (Not Manned)
Little Sohare Cr
Cottonwood Creek
Deer Cr
Prospect Dw
Ford
Trail
9686
9924
9729
9437
9638
9299
9266
8121
10,056
T43N
T42N
Exhibit A-6.
AMOCO SOHARE CREEK UNIT
SENSITIVE RESOURCE VALUES.
Legend
ANTELOPE SUMMER

APPENDIX B

Lease/Stipulations

APPENDIX B

LEASE / STIPULATIONS

SOHARE CREEK FEDERAL EXPLORATORY UNIT

TABLE OF CONTENTS

UNIT AGREEMENT STIPULATIONS B-1

I. Stipulations recommended for all areas of the Sohare Creek Unit. B-1

II. Stipulations recommended for specific portions of T42N, R111W. B-3

III. Stipulations recommended for specific portions of T42N, R112W B-5

IV. Stipulations recommended for specific portions of T43N, R111W B-6

V. Stipulations recommended for specific portions of T43N, R112W B-8

SURFACE DISTURBANCE STIPULATIONS. B-11

USDI Bureau of Land Management Stipulations for Lands under Jurisdiction of the Department of Agriculture (BLM Form 3109-3) B-11

Surface Occupancy Stipulations (FS suppliment to BLM Form 3109-3) B-15

Jackson Hole Area Oil and Gas Lease Stipulations . . . B-17

Special Stipulations B-19
Vegetation Plan B-19
Wildlife Habitat B-20
Unstable Soils B-21

UNIT AGREEMENT STIPULATIONS

I. Stipulations recommended for inclusion in all areas of the proposed Sohare Creek Unit Agreement are as follows:

A:

The licensee/permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the license/prospecting permit/lease. The Secretary of Agriculture's rules and regulations must be complied with for: (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior; (2) uses of all existing improvements, such as Forest development roads, within and outside the area licensed, permitted or leased by the Secretary of the Interior; and (3) use and occupancy of the NFS not authorized by a permit/operating plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed

to: Forest Supervisor

at: Bridger-Teton National Forest, P.O. Box 1888, Jackson, WY 83001 who is the authorized representative of the Secretary of Agriculture.

Telephone No.: (307) 733-2572

B:

The lands embraced in this lease being within the area designated in the memorandum of August 15, 1947, by the Secretary of the Interior ("Oil and Gas Leases in the Jackson Hole, Wyoming Area"; Federal Register, August 30, 1947, page 5859), which specifies the general condition under which the unitized development of the oil and gas resources is authorized, the lessee hereby agrees:

(1) To drill only such wells on the leased land as may be authorized by the Secretary of the Interior under an approved unit plan; to drill no well within 1250 feet of any public road on or adjacent to the leased land without the consent of the Secretary of the Interior first had and obtained; to refrain from defacing, injuring, or destroying trees, shrubs, or natural features, or removing same outside of the authorized work limits or pipeline and road rights-of-way as established pursuant to or revised in accordance with the unit plan. After designation of

the authorized work limits by the Secretary of the Interior or his representatives, lessee shall mark such limits by some acceptable visual means. The location of camps, storage, parking of equipment, and storage of materials shall be confined within the authorized work limits. Sludge or other waste by-products from drilling or operations shall be so confined or disposed of that they do not destroy scenic values or wildlife or pollute streams.

(2) To remove at the termination of drilling operations, all camps and buildings not essential to a continuing operation of any well, and to fill all sump holes, ditches, and other excavations, remove or cover all debris, and to restore the sites to a neat and presentable condition appropriate to the surrounding landscape, and, upon partial or total relinquishment, cancellation or expiration of this lease as to that part of the leased land to which his rights have terminated, so far as reasonably possible, to restore the surface of the leased land to its former condition to the extent deemed necessary by the Secretary of the Interior and the Regional Forester, U.S. Forest Service, Ogden, Utah, or their authorized representatives.

(3) To keep to an absolute minimum the number of access, tote roads and other travelways necessary to conduct the lessee's operations, the location of which shall be designated by the Supervisor prior to the time of their construction. Access to existing public highways shall be determined by the Supervisor at such points on the highways with due regard for sight distance restrictions, safety, or scenic considerations. The location, alignment and cross-section of all roads constructed for the convenience of lessee's operations, shall be such that after discontinuance of use, they can be obliterated and the area over which they traverse can be restored to its original condition. All types of roads constructed for operational uses shall, at the termination of these uses, be obliterated where required and the area over which they traversed restored in such a manner that revegetation will be encouraged. All roads constructed for operational purposes are to be considered as private roads and the erection of signs, locked gates, or other devices that may be required, at the discretion of the Forest Supervisor, to discourage or prevent their use by the public shall be constructed and maintained by the lessee.

(4) To protect the scenic and aesthetic values of roadsides, waterfronts, and recreation area zones as far as possible consistent with the authorized use in connection with construction, operation and maintenance facilities.

(5) To conduct operations in a manner that will offer the least possible disturbance to wildlife on or adjacent to the leased land; to exercise no methods of control or interference with such wildlife without authority first obtained from the authorized

representative of the Secretary of the Interior and/or the State Game and Fish Commission; to make no claim against the Government or the State on account of damage by such wildlife to improvements placed on the leased land.

(6) To observe and comply with all State and Federal laws and regulations relating to wildlife and to take such action as is necessary to assure observation and compliance with these laws and regulations by lessee's employees and agents.

As to any land within the Cache Creek Municipal Watershed, the lease will contain the following additional stipulations:

(7) To comply with plans heretofore made through agreement with the Forest Service and the Town Council of Jackson, Wyoming, for the protection from pollution of the municipal water during the term of this lease or any extension thereof.

II. Stipulations recommended for inclusion in specific portions of the proposed Sohare Creek Unit Agreement are as follows:

T42N, R111W

A:

The lessee/operator is given notice that all or portions of the proposed unit area may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface and/or other resources. Any surface use or occupancy within such special areas will be strictly controlled or, if necessary, excluded. Use or occupancy will be authorized only when the lessee/operator demonstrates that the special area is essential for operations in accordance with a surface use and operations plan which is satisfactory to the Bureau of Land Management Survey and the Federal surface management agency for the protection of such special areas and existing or planned uses. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing oil and gas wells; however, in extremely critical situations, occupancy may only be allowed in emergencies.

After the Federal surface management agency has been advised of specific proposed surface use or occupancy on these lands, and on request of the lessee/operator, the agency will furnish more specific locations and additional information on such special areas which now include:

Elk migration - late fall

Elk and Moose winter - December 1 to May 1

Elk calving - May 15 to June 30

Elk and Antelope summer - Summer months

Unstable soils - year long

B:

The lessee/operator agrees not to occupy or use the surface of the leased lands in T42N, R111W because of technically unsuitable soils except for certain limited uses as permitted in writing by an authorized officer of the surface management agency. This stipulation, at a later date, may be modified, supplemented, eliminated, or remain unchanged. Alteration of the stipulation will be conditional upon the preparation of a site-specific environmental assessment, or if required, an environmental impact statement. In the event this stipulation is eliminated, it will be replaced by other special stipulations as required to protect the surface resources.

C:

No occupancy or other surface disturbance will be allowed on slopes in excess of 40 percent, without written permission from the District Engineer of the Bureau of Land Management, with the concurrence of the authorized officer of the Federal surface management agency.

D:

Activity Coordination Stipulation. This lease includes lands within visually sensitive areas which has resource values sensitive to high levels of activity. In order to minimize impacts to these resources, special conditions, such as unitization prior to approval of operations, and/or other limitations to spread surface disturbance activities over time and space may be required prior to approval and commencement of any operations on the lease.

E:

To maintain esthetic values, all semi-permanent and permanent facilities may require painting or camouflage to blend with the natural surrounding. The paint selection or method of camouflage will be subject to approval by the District Engineer of the Bureau of Land Management with the concurrence of the authorized officer of the Federal surface management agency.

III. Stipulations recommended for inclusion in specific portions of the proposed Sohare Creek Unit Agreement are as follows:

T42N, R112W

A:

The lessee/operator is given notice that all or portions of the proposed unit area may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface an/or other resources. Any surface use or occupancy within such special areas will be strictly controlled or, if necessary, excluded. Use or occupancy will be authorized only when the lessee/operator demonstrates that the special area is essential for operations in accordance with a surface use and operations plan which is satisfactory to the Bureau of Land Management and the Federal surface management agency for the protection of such special areas and existing or planned uses. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing oil and gas wells; however, in extremely critical situations, occupancy may only be allowed in emergencies.

After the Federal surface management agency has been advised of specific proposed surface use or occupancy on these lands, and on request of the lessee/operator, the agency will furnish more specific locations and additional information on such special areas which now include:

Elk migration - late fall

Elk and Moose winter - December 1 to May 1

Elk calving - May 15 to June 30

Elk and Antelope summer - Summer months

Unstable soils - year long

B:

The lessee/operator agrees not to occupy or use the surface of the leased lands in T42N, R112W because of technically unsuitable soils except for certain limited uses as permitted in writing by an authorized officer of the surface management agency. This stipulation, at a later date, may be modified, supplemented, eliminated, or remain unchanged. Alteration of the stipulation will be conditional upon the preparation of a site-specific environmental assessment, or if required, an environmental impact statement. In the event this stipulation is eliminated, it will be replaced by other special stipulations as required to protect the surface resources.

C:

No occupancy or other surface disturbance will be allowed on sloped in excess of 40 percent, without written permission from the District Engineer of the Bureau of Land Management, with the concurrence of the authorized officer of the Federal surface management agency.

D:

Activity Coordination Stipulation. This lease includes lands within visually sensitive areas which has resource values sensitive to high levels of activity. in order to minimize impacts to these resources, special conditions, such as unitization prior to approval of operations, and/or other limitations to spread surface disturbance activities over time and space may be required prior to approval and commencement of any operations on the lease.

E:

To maintain esthetic values, all semi-permanent and permanent facilities may require painting or camouflage to blend with the natural surroundings. The paint selection or method of camouflage will be subject to approval by the District Engineer of the Bureau of Land Management with the concurrence of the authorized officer of the Federal surface management agency.

F:

No occupancy or other activity on the surface of the following described lands is allowed under this unit agreement.

NW NE Sec. 14, T42N, R112W - Administrative site

IV. Stipulations recommended for inclusion in specific portions of the proposed Sohare Creek Unit Agreement are as follows:

T43N, R111W

A:

The lessee/operator is given notice that all or portions of the proposed unit area may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface an/or other resources. Any surface use or occupancy within such special areas will be strictly controlled or, if necessary, excluded. Use or occupancy will be authorized only when the lessee/operator demonstrates that the special area is essential for operations in accordance with a surface use and

operations plan which is satisfactory to the Bureau of Land Management and the Federal surface management agency for the protection of such special areas and existing or planned uses. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing oil and gas wells; however, in extremely critical situations, occupancy may only be allowed in emergencies.

After the Federal surface management agency has been advised of specific proposed surface use or occupancy on these lands, and on request of the lessee/operator, the agency will furnish more specific locations and additional information on such special areas which now include:

Elk migration - late fall

Elk Summer - Summer months

B:

The lessee/operator agrees not to occupy or use the surface of the leased lands in T43N, R111W because of technically unsuitable soils except for certain limited uses as permitted in writing by an authorized officer of the surface management agency. This stipulation, at a later date, maybe modified, supplemented, eliminated, or remain unchanged. Alteration of the stipulation will be conditional upon the preparation of a site-specific environmental assessment, or if required, an environmental impact statement. In the event this stipulation is eliminated, it will be replaced by other special stipulations as required to protect the surface resources.

C:

No occupancy or other surface disturbance will be allowed on slopes in excess of 40 percent, without written permission from the District Engineer of the Bureau of Land Management, with the concurrence of the authorized officer of the Federal surface management agency.

D:

Activity Coordination Stipulation. This lease includes lands within visually sensitive areas which has resource values sensitive to high levels of activity. In order to minimize impacts to these resources, special conditions, such as unitization prior to approval of operations, and/or other limitations to spread surface disturbance activities over time and space maybe required prior to approval and commencement of any operations on the lease.

E:

To maintain esthetic values, all semi-permanent and permanent facilities may require painting or camouflage to blend with the natural surroundings. The paint selection or method of camouflage will be subject to approval by the District Engineer of the Bureau of Land Management with the concurrence of the authorized officer of the Federal surface management agency.

F:

Protection of Endangered or Threatened Species. The Federal surface management agency is responsible for assuring that the area to be disturbed is examined, prior to undertaking any surface-disturbing activities on lands covered by this lease, to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. If the findings of this examination determine that the operation may detrimentally affect and endangered or threatened species, some restrictions to the operator's plans or even disallowances of use may result.

The lessee/operator may, at his discretion and cost, conduct the examination on the lands to be disturbed. This examination must be done by or under the supervision of a qualified resource specialist approved by the surface management agency. An acceptable report must be provided to the surface management agency identifying the anticipated effects of the proposed action on endangered or threatened species or their habitat.

V. Stipulations recommended for inclusion in specific portions of the proposed Sohare Creek Unit Agreement are as follows:

T43N, R112W

A:

The lessee/operator is given notice that all or portions of the proposed unit area may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface and/or other resources. Any surface use or occupancy within such special areas will be strictly controlled or, if necessary, excluded. Use or occupancy will be authorized only when the lessee/operator demonstrates that the special area is essential for operations in accordance with a surface use and operations plan which is satisfactory to the Bureau of Land Management and the Federal surface management agency for the protection of such special areas and existing or planned uses. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing oil and gas wells;

however, in extremely critical situations, occupancy may only be allowed in emergencies.

After the Federal surface management agency has been advised of specific proposed surface use or occupancy on these lands, and on request of the lessee/operator, the agency will furnish more specific locations and additional information on such special areas which now include:

Elk migration - late fall

Elk Summer - Summer months

Unstable soils - year long

B:

The lessee/operator agrees not to occupy or use the surface of the leased lands in T43N, R112W because of technically unsuitable soils except for certain limited uses as permitted in writing by an authorized officer of the surface management agency. This stipulation, at a later date, may be modified, supplemented, eliminated, or remain unchanged. Alteration of the stipulation will be conditional upon the preparation of a site-specific environmental assessment, or if required, and environmental impact statement. In the event this stipulation is eliminated, it will be replaced by other special stipulations as required to protect the surface resources.

C:

No occupancy or other surface disturbance will be allowed on slopes in excess of 40 percent, without written permission from the District Engineer of the Bureau of Land Management, with the concurrence of the authorized officer of the Federal surface management agency.

D:

Activity Coordination Stipulation. This lease includes lands within visually sensitive areas which has resource values sensitive to high levels of activity. In order to minimize impacts to these resources, special conditions, such as unitization prior to approval of operations, and/or other limitations to spread surface disturbance activities over time and space may be required prior to approval and commencement of any operations on the lease.

E:

To maintain esthetic values, all semi-permanent and permanent facilities may require painting or camouflage to blend with the

natural surrounding. The paint selection or method of camouflage will be subject to approval by the District Engineer of the Bureau of Land Management with the concurrence of the authorized officer of the Federal surface management agency.

F:

Protection of Endangered or Threatened Species. The Federal surface management agency is responsible for assuring that the area to be disturbed is examined, prior to undertaking any surface-disturbing activities on lands covered by this lease, to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. If the findings of this examination determine that the operation may detrimentally affect and endangered or threatened species, some restrictions to the operator's plans or even disallowances of use may result.

The lessee/operator may, at his discretion and cost, conduct the examination on the lands to be disturbed. This examination must be done by or under the supervision of a qualified resource specialist approved by the surface management agency. An acceptable report must be provided to the surface management agency identifying the anticipated effects of the proposed action on endangered or threatened species or their habitat.

Form 3109-3
(June 1971)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
STIPULATION FOR LANDS UNDER JURISDICTION
OF DEPARTMENT OF AGRICULTURE

The lands embraced in this lease or permit being under the jurisdiction of the Secretary of Agriculture, the lessee or permittee hereby agrees:

(1) To conduct all operations authorized by this lease or permit with due regard for good land management, not to cut or destroy timber without first obtaining permission from the authorized representative of the Secretary of Agriculture, and to pay for all such timber cut or destroyed at the rates prescribed by such representative; to avoid unnecessary damage to improvements, timber, crops, or other cover; unless otherwise authorized by the Secretary of Agriculture, not to drill any well, carry on operations, make excavations, construct tunnels, drill, or otherwise disturb the surface of the lands within 200 feet of any building standing on the lands and whenever required, in writing, by the authorized representative of the Secretary of Agriculture to fence or fill all sump holes, ditches, and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the lands to their former condition, including the removal of structures as and if required, and when required by such representative to bury all pipelines below plow depth.

(2) To do all in his power to prevent and suppress forest, brush, or grass fires on the lands and in their vicinity, and to require his employees, contractors, subcontractors, and employees of contractors or subcontractors to do likewise. Unless prevented by circumstances over which he has no control, the lessee or permittee shall place his employees, contractors, subcontractors, and employees of contractors and subcontractors employed on the lands at the disposal of any authorized officer of the Department of Agriculture for the purpose of fighting forest, brush, or

---

*This form of stipulation may be used in connection with leases and permits issued under the Acts of February 25, 1920, as amended (30 U.S.C. 181 et seq.); August 7, 1947 (30 U.S.C. 351 et seq.); February 7, 1927, as amended (30 U.S.C. 281 et seq.); April 17, 1926, as amended (30 U.S.C. 271 et seq.); June 28, 1944(38 Stat. 483-485); September 1, 1949(30 U.S.C. 192 c); June 30, 1950 (16 U.S.C. 508b); or under the authority of any of the Acts cited in Section 402 of the President's Reorganization Plan No. 3 of 1946 (5 U.S.C. 133 y-16 Note).

grass fires on or originating on the lands or on adjacent areas or caused by the negligence of the lessee or permittee or his employees, contractors, subcontractors and employees of contractors and subcontractors, with the understanding that payment for such services shall be made at rates to be determined by the authorized representative of the prevailing in the vicinity for services of a similar character: Provided, that if the lessee or permittee, his employees, contractors, subcontractors, or employees of contractors or subcontractors, caused or could have prevented the origin or spread of said fire or fires, no payment shall be made for services so rendered.

During periods of serious fire danger to forest, brush, or grass, as may be specified by the authorized representative of the Secretary of Agriculture, the lessee or permittee shall prohibit smoking and the building of camp and lunch fires by his employees, contractors, subcontractors, and employees of contractors or subcontractors within the area involved except at established camps, and shall enforce this prohibition by all means within his power: Provided, that the authorized representative of the Secretary of Agriculture may designate safe places where, after all inflammable material has been cleared away, campfires may be built for the purpose of heating lunches and where, at the option of the lessee or permittee, smoking may be permitted.

The lessee or permittee shall not burn rubbish, trash, or other inflammable materials except with the consent of the authorized representative of the Secretary of Agriculture and shall not use explosives in such a manner as to scatter inflammable materials on the surface of the lands during the forest, brush, or grass fire season, except as authorized to do so or on areas approved by such representative.

The lessee or permittee shall build or construct such fire lines or do such clearing on the lands as the authorized representative of the Secretary of Agriculture decides is essential for forest, brush, and grass fire prevention which is or may be necessitated by the exercise of privileges authorized by this lease or permit, and shall maintain such codes rules at his headquarters or at the appropriate location on the lands as are deemed necessary by such representative.

(3) In the location, design, construction, and maintenance of all authorized works, buildings, plants, waterways, roads, telegraph or telephone lines, pipelines, reservoirs, tanks, pumping stations, or other structures or clearance, the lessee or permittee shall do all things reasonably necessary to prevent or reduce to the fullest extent scarring and erosion of the lands, pollution of the water resources and any damage to the watershed. Where construction, operation, or maintenance of any of the facilities on or connected with this lease or permit causes

damage to the watershed or pollution of the water resources, the lessee or permittee agrees to repair such damage and to take such corrective measures to prevent further pollution or damage to the watershed as are deemed necessary by the authorized representative of the Secretary of Agriculture.

(4) If in the opinion of the authorized representative of the Secretary of Agriculture, the lands are valuable for watershed protection, the lessee or permittee shall provide for control of surface runoff and return the affected area to as productive condition as practicable.

(5) To pay the lessor or permitter or his tenant or the surface owner or his tenant, as the case may be, for any and all damage to or destruction of property caused by the lessee's or permittee's operations hereunder; to save and hold the lessor or permitter or the surface owner or their tenants harmless from all damage or claims for damage to persons or property resulting from the lessee's or permittee's operations under this lease or permit.

(6) To recognize existing uses and commitments, in the form of Department of Agriculture grazing, timber cutting, and special use permits, water developments, ditch, road, trail, pipeline, telephone line, and fence rights-of-way and other similar improvements, and to conduct his operations so as to interfere as little as possible with the rights and privileges granted by these permits or with other existing uses.

(7) To install and maintain cattle guards to prevent the passage of livestock in any openings made in fences by the lessee or permittee or his contractors to provide access to the lands covered by this lease or permit for automotive and other equipment.

(8) If lessee or permittee shall construct any camp on the lands, such camp shall be located at a place approved by the authorized representative of the Secretary of Agriculture, and such representative shall have authority to require that such camp be kept in a neat and sanitary condition.

(9) To comply with all federally-approved rules and regulations of the Secretary of Health, Education, and Welfare governing the emission of pollutants into the air from activities which are embraced in this lease or permit.

(10) To comply with all the rules and regulations of the Secretary of Agriculture governing the national forests or other lands under his jurisdiction which are embraced in this lease or permit.

(11) Unless otherwise authorized, prior to the beginning of operations to appoint and maintain at all times during the term of this lease or permit a local agent upon whom may be served written orders or notices respecting matters contained in this stipulation, and to inform the authorized representative of the Secretary of Agriculture, in writing, of the name and address of such agent. If a substitute agent is appointed, the lessee or permittee shall immediately so inform the said representative.

(12) To address all matters relating to this stipulation to

at

who is the authorized representative of the Secretary of Agriculture, or to such other representative as may from time to time, be designated, provided that such designation shall be in writing and be delivered to the lessee or permittee or his agent.

_____

(Signature of Lessee)

Forest Service Supplement to
Form 3109-3

SURFACE OCCUPANCY STIPULATION

1. Lessee agrees not to enter upon the lease area or disturb the surface for exploration or drilling purposes until either:

(a) An inventory of archeological, paleontological, and historical sites is made by the surface management agency or its designated representative, or

(b) Lessee has made or caused to be made an inventory of all archeological, paleontological, and historical sites in those areas of the lease subject to development, occupancy, or surface disturbance. The survey must be made by a qualified archeologist acceptable to the surface management agency and the results of this survey provided to the surface management agency. Costs of this survey will be borne by the lessee. After inventory by either lessee's archeologist or the surface management agency reasonable conditions of use will be prepared to protect the sites or salvage objects of antiquity in accordance with the Antiquities Act of June 8, 1906 (34 Stat. 225; 16 USC 431), and the Historical Sites Act of August 21, 1935 (49 Stat. 666; 16 USC 461-467). Costs of salvage of artifacts will be borne by the lessee and all objects of antiquity salvaged will remain the property of the U.S. Government.

2. No occupancy of the surface in the following areas is authorized by this lease. The lessee may employ directional drilling to develop the oil and gas resources under these areas, provided that such drilling or other works will not disturb the surface area or otherwise interfere with their use by the surface management agency. The areas to be excluded from surface occupancy unless specifically approved in the operating plan are:

(a) Within 500 feet on either side of the centerline of any and all roads and/or highways within the lease area.

(b) Within 200 feet on either side of the centerline of any and all designated trails within the lease area.

(c) Within 500 feet of the normal high waterline of any and all streams, lakes, ponds, and reservoir located within the lease area.

(d) Within 400 feet of any and all springs within the lease area.

(e) Within 400 feet of any improvements either owned, permitted, leased, or otherwise authorized by the surface management agency.

JACKSON HOLE AREA OIL AND GAS LEASE STIPULATION

The lands embraced in this lease being within the area designated in the memorandum of August 15, 1947, by the Secretary of the Interior ("Oil and Gas leases in the Jackson Hole, Wyoming Area"; Federal Register, August 30, 1947, page 5859), which specifies the general condition under which the unitized development of the oil and gas recovery is authorized, the lessee hereby agrees:

(1) To drill only such wells on the leased land as may be authorized by the Secretary of the Interior under an approved unit plan; to drill no well within 1250 feet of any public road on or adjacent to the leased land without the consent of the Secretary of the Interior first had and obtained; to refrain from defacing, injuring, or destroying trees, shrubs, or natural features, or removing same outside of the authorized work limits or pipeline and road rights-of-way as established pursuant to or revised in accordance with, the unit plan. After designation of the authorized work limits by the Secretary of the Interior or his representatives, lessee shall mark such limits by some acceptable visual means. The location of camps, storage, parking of equipment, and storage of materials shall be confined within the authorized work limits, Sludge or other waste by-products from drilling or operations shall be so confined or disposed of that they do not destroy scenic or wildlife or pollute steams.

(2) To remove at the termination of drilling operations, all camps and buildings not essential to a continuing operation of any well, and to fill all sump holes, ditches and other excavations, remove or cover all debris, and to restore the sites to a right and presentable condition appropriate to the surrounding landscape, and, upon partial or total relinquishment, cancellation or expiration of this lease as to that part of the leased land to which his rights have terminated, so far as reasonably possible, to restore the surface of the leased land to its former condition to the extent deemed necessary by the Secretary of the Interior and the Regional Forester, U.S. Forest Service, Ogden, Utah, or their authorized representatives.

(3) To keep to an absolute minimum the number of access, tote roads and other travelways necessary to conduct the lessee's operations, the location of which shall be designated by the Supervisor prior to the time of their construction. Access to existing public highways shall be determined by the Supervisor at such points on the highways with due regard for sight distance restrictions, safety, or scenic considerations. The location, alignment and cross-section of all roads constructed for the convenience of lessee's operations, shall be such that after discontinuance of use, they can be obliterated and the area over which they traverse can be restored to its original condition. All types of roads constructed for operation uses shall, at the termination of these uses be obliterated where required and the

area over which they traversed restored in such a manner that revegetation will be encouraged. All roads constructed for operational purposes are to be considered as private roads and the erection of signs, locked gates, or other devices that may be required, at the discretion of the Supervisor, to discourage or prevent their use by the public shall be constructed and maintained by the lessee.

(4) To protect the scenic and aesthetic values of roadsides, waterfronts, and recreation area zones as far as possible consistent with the authorized use in connection with construction, operation and maintenance facilities.

(5) To conduct operations in a manner that will offer the least possible disturbance to wildlife on or adjacent to the leased land; to exercise no methods of control or interference with such wildlife without authority first obtained from the authorized representative of the Secretary of the Interior and/or the State Game and Fish Commission; to make no claim against the Government or the State on Account of damage by such wildlife to improvements placed on the leased land.

(6) To observe and comply with all State and Federal laws and regulations relating to wildlife and to take such action as is necessary to insure observation and compliance with these laws and regulations by lessee's employees and agents.

As to any land within the Cache Creek Municiple Watershed, the lease will contain the following stipulation:

(7) To comply with plans heretofore made through agreement with Forest Service and the Town Council of Jackson, Wyoming, for the protection from pollution of the municiple water during the term of this lease or any extension thereof.

SPECIAL STIPULATION

The lessee will not undertake any drilling, construction of roads or pipelines, or any other activity which involves removal of vegetation until a plan of construction and development has been approved by the Forest Service representative. Such approval may be conditioned on reasonable requirements to prevent erosion, water pollution, or damage to surface resources and to provide for restoration of the surface.

SPECIAL WILDLIFE HABITAT STIPULATION

The lease area contains critical habitat for certain wildlife species. Of paramount concern on this lease area are: elk calving, elk and moose forage areas, and grizzly bear. Therefore, prior to entry onto the leasehold, the operator will jointly discuss the proposed activities with the Area Oil and Gas Supervisor or his representative, the Forest Supervisor or his representative, and the Wyoming Game and Fish Department. Additional measures may be required to protect the above species and habitat features, these include:

a. No surface occupancy of selected areas;

b. Restrictions on season of operation;

c. Special reclamation techniques and/or requirements;

d. Restrictions on rate of development and spacing and location of wells;

e. Special road closure requirements.

UNSTABLE SOILS STIPULATION

The lands within this leasehold contain unstable/highly erodible soils. Therefore, prior to entry onto the lands, the lesse (operator) will discuss the proposed activities jointly with the Area Oil and Gas Supervisor or designated representative and the Forest Supervisor or designated representative. Additional measures for the protection of the soils may be required. Such measures for the protection of the soils may include:

a. No surface occupancy of selected areas;

b. Restriction on surface entry during paddies of excessive runoff;

c. Special requirements for reserve pits and drilling fluid systems.

APPENDIX C

C-1 Vegetation, Timber, and Range Resources
C-2 Visual Resources
C-3 Recreation Resources
C-4 Soil Resources
C-5 Land Use

APPENDIX C-1

Vegetation, Timber, and Range Resources

General Vegetation Community Types
within the Affected Environment of
AMOCO's Proposed Well Site No.1-35
and Access Alternative

Uplands:

Spruce-Fir Community Type. The Spruce-Fir vegetation community type covers the majority of the study area. This type consists of a relatively dense overstory canopy dominated by Engelmann spruce (Picea engelmannii), subalpine-fir (Abies lasiocarpa), lodgepole pine (Pinus contorta), white-bark pine (Pinus albicaulis), and aspen (Populus tremuloides) depending on the successional stage and habitat type of a particular stand. The understory shrub canopy is comprised primarily of blue huckleberry (Vaccinium globulare), and grouse whortleberry (Vaccinium scoparium), mountain gooseberry (Ribes montigenum), squaw current (Ribes cereum), and buffaloberry (Shepherdia canadensis). Sub-shrubs include Oregon grape (Berberis repens) and mountain lover (Pachystima myrsinites). Below the shrub layer a graminoid-forb layer exists which is highly variable in cover and species composition. The most common forbs include: heartleaf arnica (Arnica cordifolia), mountain arnica (Arnica latifolia), sweet-root (Osmorhiza chilensis and O. depauperata), western meadowrue (Thalictrum occidentale), fireweed (Epilobium angustifolium), aster (Aster spp.), violet (Viola orbiculata), strawberry (Fragaria vesca), sidebells (Pyrola secunda), Richardson geranium (Geranium richardsonii), and pedicularis (Pedicularis racemosa). In moist areas where surface seepage occurs baneberry (Actea rubra), arrowleaf groundsel (Senecio triangularis), and twisted stalk (Streptopus amplexifolius) flourish. The most common graminoids include: pinegrass (Calamagrostis rubescens), fringed brome (Bromus ciliatus), brome (Bromus vulgaris), wheeler bluegrass (Poa nervosa), alpine timothy (Phleum alpinum), blue wild-rye (Elymus glaucus), elk sedge (Carex geyeri), and Ross sedge (Carex rossii). Total vegetal cover is quite high ranging from 70 to 100 percent.

Within the study area this community type represents several climax habitat types as described by Steele et al (1983). Subalpine-fir is the indicated climax species. The subalpine-fir/grouse whortleberry (ALBA/VASC) habitat type is the most widespread, covering the vast majority of the Spruce-Fir community type. Three phases of this habitat type are represented including the grouse whortleberry (VASC), pinegrass (CARU), and whitebark pine (PIAL) phases.

This community type contains valuble timber resources much of which occurs in old growth stands. According to Steele et al.

(1983) timber productivity ranges mainly from low to moderate (20 to 85 ft^3 per year). Average basal area ranges from 111 to 223 ft^2 per acre with standard deviation ranging from 27 to 39. Site index ranges from 28 to 37 for lodgepole pine , 37 to 40 for Engelmann spruce, and 25 to 33 for subalpine fir depending on habitat type phase. This type is managed for its timber resource, wildlife habitat, and range resource.

Mixed Pine. This community type consists of forest stands dominated by lodgepole pine and whitebark pine. In relatively dense stands, the structural character, species composition, and habitats of this community type are very similar to that described for spruce-fir. Of the stands dominated by whitebark pine, the predominant habitat types include whitebark pine/grouse whortleberry, whitebark pine/elk sedge, and whitebark pine/common juniper.

In addition to the dense stands previously described, whitebark pine may dominate with subalpine fir in open park-like stands on harsher and drier sites with shallow soil. A relatively sparse shrub layer exists below the tree canopy which consists of Wyoming big sagebrush (Artemisia tridentata wyomingensis), mountain big sagebrush (A. Tridentata vaseyana), buffaloberry, elderberry (Sambucus caerulea), mountain snowberry (Symphoricarpos oreophilos), and antelope bitterbrush (Purshia tridentata). A sparse to dense forb and graminoid layer exists between the shrubs and trees depending on the site exposure and depth of soils. The most common forb species include: geranium (Geranium spp.), scarlet gilia (Ipomopsis aggregata), penstemon (Penstemon spp.), hoods phlox (Phlox hoodii), lupine (Lupinus spp.), owl-clover (Orthocarpus spp.), paintbrush (Castilleja spp.), mountain bluebells (Mertensia ciliata), giant-hyssop (Agastache urticifolia), blueflax (Linum lewisii), fireweed, sulphurflower (Eriogonum umbellatum), common harebell (Companula rotundifolia), mules-ears (Wyethia amplexicaulis), and western coneflower (Rudbeckia occidentalis). The most common graminoids include: bluebunch wheatgrass (Agropyron spicatum), spreading wheatgrass (A. scribneri), slender wheatgrass (A. trachycaulum), alpine timothy (Phleum alpinum), brome (Bromus spp.), elk sedge (Carex geyeri), and Ross sedge (C. rossii). Total vegetal cover is also highly variable depending on the particular site. In drier exposed areas, typical cover may be as low as 30 percent, while in moist protected areas, cover may be as high as 80 percent.

Timber Harvest Community Type. The timber harvest community type is located within the spruce-fir and mixed pine types where timber has been harvested. Generally, plant species present include those remaining from pre-harvest and species that have

become established after harvest. Seedling and sapling lodgepole pine and Engelmann spruce dominate the overstory of this type. These trees are the result of both natural regeneration and planting. Shrubs are important components and include squaw current, mountain gooseberry, blue huckleberry, buffaloberry, mountain lover, alder (Alnus sinuata), sticky-laurel (Ceanothus velutinus), and elderberry. Typical forbs include: strawberry, yarrow (Achillea millefolium), aster (Aster spp.), goldenrod (Solidago multiradiata), sticky geranium (Geranium viscosissimum), fireweed and violet (Viola orbiculata). This type typically has a dense graminoid cover which include: Scribner wheatgrass (Agropyron scribneri), slender wheatgrass (A. trachycaulum), alpine timothy (Phleum alpinum), spike trisetum (Trisetum spicatum), elk sedge, and ross sedge. Total vegetal cover is variable with an average of approximately 80 to 90 percent. This type is managed for its range resource, wildlife habitat, and timber resources.

Sagebrush. This shrubland type has wide distribution within the affected environment and occupies lower elevation sites on valley bottoms and hillslopes at lower to mid elevations. At lower elevations, this type is dominated by Wyoming big sagebrush in association with mountain snowberry, antelope bitterbrush, and rabbitbrush. At higher elevations on midslope positions with shallow soils, this type is dominated by black sagebrush (Artemisia nova). Forb and graminoid components include the species listed for the open park-like stands of the mixed pine type. Near streams or on areas that are perennially subirrigated, this type is often dominated by silver sagebrush (Artemisia cana) with forb and graminoid components being similar to that described below for wet subirrigated meadows and riparian willow. Total vegetal cover ranges from 40 percent for stands dominated by black sagebrush to 80 percent or more in stands dominated by silver sagebrush. This vegetation type is managed for its range resource for both wildlife and livestock.

Upland meadow. This type is widespread within the affected environment at mid to upper elevations primarily at valley bottom and midslope positions. This type is characterized by a dense cover of forbs and graminoids. Species typical of this type is very similar to those listed for the open park-like stands of the mixed pine type. Total vegetal varies from 40 percent on drier slopes adjacent to the sagebrush, to over 90 percent in areas with deep soil and plentiful moisture during the growing season. This type is managed primarily for its wildlife habitat and range resource.

Mountain grassland. This type has limited distribution in the affected environment and occurs at higher elevations on dry wind-

swept slopes and ridgelines with relatively shallow, rocky soils. It occurs adjacent to the open park-like stands of whitebark pine and dry meadow. This type is dominated by various bunch grasses including bluebunch wheatgrass (Agropyron spicatum), Ross sedge (Carex rossii), Idaho fescue (Festuca idahoensis), spike fescue (Hesperochloa kingii), and Wheeler bluegrass (Poa nervosa). Associated forbs include many of those listed for the open park-like stands of mixed pine. Shrubs typical of the sagebrush type are often sparsely distributed in this type. Total vegetal cover ranges from 40 to 80 percent. This type is primarily managed for its wildlife habitat and range resource.

Wetlands:

Wet subirrigated meadows. This type is distributed along stream valleys with the riparian willow type. This type is characterized by an intermittently to perennially wet or saturated soil or subsoil. Therefore, hydrophytic plant species predominate. The most common forb and graminoid species include: sedges (Carex spp.), rushes (Juncus spp.), tufted hairgrass (Deschampsia caespitosa), inland bluegrass (Poa interior), wild strawberry , mountain blue violet, marsh marigold (Caltha leptosepala), bistort (Polygonum bistortoides), cinquefoil (Potentilla spp.), and buttercup (Ranunculus spp.). Shrubs consisting primarily of willow, silver sagebrush, and bushy cinquefoil may be sparsely distributed throughout this type with densities less than 10 percent. Typically, vegetal cover is very dense varying between 90 and 100 percent. This type is managed for wildlife habitat and is also utilized by rangeland livestock for forage. This type is a unique and important community since it is relatively rare in the area, covers a relatively small cumulative area, provides unique and important wildlife habitat, and is an important component of hydrologic systems.

Riparian willow. This type occurs at valley bottom positions in association with perennial and intermittent streams as well as perennial seeps. It is dominated by one or more species of willow including: Wolf willow (Salix wolfii), Booth willow (Salix boothii), and Drummonds willow (Salix drummondiana). Understory species include shrubby cinquefoil (Potentilla fruticosa), Kentucky bluegrass (Poa pratensis), miterwort (Mitella pentandra), alpinebog swertia (Swertia perennis) as well as species listed for the wet subirrigated meadow type. Cottonwood trees (Populus angustifolia) may also be distributed in this type at lower elevations in the southern portions of the affected environment along the Gros Ventre River and Cottonwood Creek and tributaries. Total vegetal cover ranges from 70 to 100 percent. The type is also a unique and important community for the same reasons as described for the wet subirrigated meadow. It is primarily managed for its wildlife habitat and range resources.

APPENDIX C-2

Visual Resource Definitions

APPENDIX C-2

Visual Resource Definitions

Distance Zones:

The visual effects of a given management activity on a user clearly decreases as the distance between the user and the activity increases. In order to quantify this effect, three distance zones from the viewer are defined. They are:

- Foreground 0-1/2 mile
- Middleground 1/2-4 miles
- Background 4-10 miles

Sensitivity Levels:

Sensitivity levels provide a relative measure of a landscape's aesthetic importance or value from the standpoint of location and visual exposure to the public, whether they are recreationists, local residents, ranchers, forest product workers, or Forest Service personnel. It is recognized that all National Forest land is seen at some time at least by aircraft users. Therefore, some degree of visitor sensitivity is established for the entire land base.

Three sensitivity levels are used. Each one identifies a different level of visual exposure. They are:

- Level 1 - Highest
- Level 2 - Average
- Level 3 - Lowest

Variety Class:

The inherent scenic quality of the land making up the Bridger-Teton is, for planning purposes, equated with landscape variety. Any area of this land is allocated to one of the tree variety classes. This determines those landscapes which are most important and those which are of lesser value from the standpoint of scenic quality.

The classification is based on the premise that all landscapes have some value, but those with the most variety or diversity have the greatest potential for high scenic value. There are three variety classes which identify the scenic quality of the natural landscape.

- Class A - Distinctive
  Refers to those areas where landforms and rock formations, vegetative patterns and water features are of unusual or outstanding visual quality.

- Class B - Common
  Refers to those areas where features do contain variety in form, line, color, and/or texture but to a degree that tends to be common throughout the area. The features are not outstanding in visual quality.

- Class C - Minimal
  Refers to those areas whose features have little change in form, line, color, and/or texture. this class includes all areas that do not fit into Classes A or B.

Visual Absorption Capability:

Visual Absorption Capability is a measure of the relative ability of the land to absorb visual change.

Visual Quality Levels:

Visual Quality Levels represent measurable standards for the visual management of the Forest. These standards are a result of combining the inherent scenic quality (Variety classes) and the landscape's aesthetic importance (Sensitivity Levels).

- P - Preservation
  This visual quality objective allow ecological change only. Management activities except for low visual impact recreation facilities are prohibited.

- R - Retention
  This visual quality objective provides for management activities which are not visually evident.

- PR - Partial Retention
  Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention visual quality objective.

- M - Modification
  Under the modification visual quality objective management activities may visually dominate the original characteristic landscape. However, activities of vegetative and landform alteration must borrow from naturally established form, line, color or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Additional parts of these activities such as structures, roads, slash, root wads, etc., must remain visually subordinate to the proposed composition.

- MM - Maximum Modification
  Management activities of vegetative and landform alteration may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middle ground they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or obtain detail which is incongruent with natural occurrences as seen in foreground or middle ground.

These levels are derived from the values established in the Variety classes and Sensitivity Levels. Except for Preservation, each describes a different degree of acceptable alteration of the natural landscape. The degree of alteration due to management activities is measured in terms of visual contrast with the surrounding landscape that is generated by introduced changes in form, line, color, or texture.

Overall Character:

- Man natural mix to man dominated
  Where moderate levels of scenic quality (partial retention and modification are lowered in quality to modification and/or maximum modification).

- Scenic natural to man dominated
  Where high level of scenic quality (preservation or retention) are lower in quality to partial retention objective.

- Common natural to man dominated
  Where moderate levels of scenic quality which appear undisturbed by human activity (retention, partial retention, or modification, common variety class) are lowered in quality to modification or maximum modification because of the visible nature of the man induced mix.

- Common natural to man natural mix
  Where moderate levels of scenic quality which appear undisturbed by human activity (retention, partial retention, or modification, Common variety class are lowered in class to modification because of the visible nature of the man induced disturbance.

APPENDIX C-3

Recreation Resources

APPENDIX C-3

Recreation Opportunity Spectrum

Size Criteria

Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
5,000 acres*	2,500 acres**	2,500 acres	No size criteria.	No size criteria.	No size criteria.

*May be smaller if contiguous to Semi-Primitive Nonmotorized Class.
**May be smaller if contiguous to Primitive Class.

Remoteness Criteria*

Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
An area designated at least 3 miles from all roads, railroads or trails with motorized use	An area designated at least ½-mile but not further than 3 miles from all roads, railroads or trails with motorized use; can include the existence of primitive roads and trails if usually closed to motorized use.	An area designated within ½-mile of primitive roads or trails used by motor vehicles; but not closer than ½-mile from better than primitive roads.	An area designated within ½-mile from better than primitive roads, and railroads.	No distance criteria.	No distance criteria.

*The criteria can be modified to conform to natural barriers and screening, or other relevant features of local topographic relief and vegetative cover. This fits the criteria to the actual Forest landscape.

Social Setting Criteria*

Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Usually less than 6 parties per day encountered on trails and less than 3 parties visible at campsite.	Usually 6 -15 parties per day encountered on trails and 6 or less visible at campsites.	Low to moderate contact frequency. * *	Frequency of contact is: * * Moderate to High on roads. Low to Moderate on trails and away from roads.	Frequency of contact is: * * Moderate to High in developed sites, on roads and trails, and water surfaces. Moderate away from developed sites.	Large numbers of users onsite and in nearby areas

* These criteria apply during the typical recreation use season. Peak days may exceed these limits.
* * Specific numbers must be developed to meet regional or local conditions.

Evidence of Humans Criteria

Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Setting is essentially an unmodified natural environment. Evidence of humans would be unnoticed by an observer wandering through the area.	Natural* setting may have subtle modifications that would be noticed but not draw the attention of an observer wandering through the area.	Natural* setting may have moderately dominant alterations but would not draw the attention of motorized observers on trails and primitive roads within the area.	Natural* setting may have modifications which range from being easily noticed to strongly dominant to observers within the area. However from sensitive** travel routes and use areas these alterations would remain unnoticed or visually subordinate.	Natural* setting is culturally modified to the point that it is dominant to the sensitive** travel route observer. May include pastoral, agricultural, intensively managed wildland resource landscapes, or utility corridors. Pedestrian or other slow moving observers are constantly within view of culturally changed landscape.	Setting is strongly structure dominated. Natural or natural-appearing elements may play an important role but be visually subordinate. Pedestrian and other slow moving observers are constantly within view of artificial enclosure of spaces.
Evidence of trails is acceptable, but should not exceed standard to carry expected use.	Little or no evidence of primitive roads and the motorized use of trails and primitive roads.	Strong evidence of primitive roads and the motorized use of trails and primitive roads.	There is strong evidence of designed roads and/or highways.	There is strong evidence of designed roads and/or highways.	There is strong evidence of designed roads and/or highways and streets.
Structures are extremely rare.	Structures are rare and isolated.	Structures are rare and isolated.	Structures are generally scattered, remaining visually subordinate or unnoticed to the sensitive** travel route observer. Structures may include power lines, microwave installations and so on.	Structures are readily apparent and may range from scattered to small dominant clusters including power lines, microwave installations, local ski areas, minor resorts and recreation sites.	Structures and structure complexes are dominant, and may include major resorts and marinas, national and regional ski areas, towns, industrial sites, condominiums or second home developments.

*In many southern and eastern forests what appears to be natural landscapes may in actuality have been strongly influenced by humans. The term natural-appearing may be more appropriate in these cases.
**Sensitivity level 1 and 2 travel routes from Visual Management System USDA Handbook 461.

Managerial Setting Criteria

Primitive	Semi-Primitive Non-Motorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
On-site regimentation is low with controls* primarily off-site.	On-site regimentation and controls* present but subtle.	On-site regimentation and controls* present but subtle.	On-site regimentation and controls* are noticeable, but harmonize with the natural environment.	Regimentation and controls* obvious and numerous, largely in harmony with the man-made environment.	Regimentation and controls* obvious and numerous.

*Controls can be physical (such as barriers or regulatory (such as permits).

Taken from 1986 ROS Book , USDA Forest Service

APPENDIX C-4

Soil Interpretation Ratings for Roads and Drill Site

APPENDIX C-4

Soil Interpretation Ratings for Roads and Drill Site

STABILITY

High: A high probability that mass movement will occur. Mass movement may occur frequently over a period of years. Frequent maintenance may be required to repair affected areas. Also a high risk of related effects such as sedimentation of watersheds, loss of vegetation, and scars on the landscape.

Moderate: A near even probability that mass movement will occur. Mass movement may occur occasionally over a period of years. occasional maintenance may be needed to repair affected areas. Also a moderate risk of related effects such as sedimentation of watersheds, loss of vegetation, and scars on the landscape.

Low: A low probability that mass movement will occur. Mass movement will occur infrequently or not at all. Infrequent or no maintenance will be required to repair affected areas.

EROSION

High: Cuts and fills will yield large volumes of sediment. Accumulated sediment may fill road ditches, drainage structures, or sediment traps within a short period of time. Special precautions need to be taken to see that sediment movement is controlled and adverse effects on the watershed are prevented.

Moderate: Cuts and fills will yield moderate volumes of sediment. Short term exposure normally does not cause serious negative effects. Precautions need to be taken to see that sediment movement is controlled and adverse effects on the watershed are prevented.

Low: Cuts and fills will yield small volumes of sediment. Exposure normally does not cause serious negative effects. Minimal precautions can usually control sediment movement and prevent adverse effects to the watershed.

REVEGETATION

The expected rate of vegetation reestablishment on disturbed soils.

Good: Acceptable response can be expected in the first year following revegetation. Soil and topographic characteristics are favorable.

Fair: Limited response can be expected the first year. More than one year may be needed to establish acceptable cover. Characteristics such as high rock fragment content or steep slopes are limiting. Special management practices may enhance the rate of establishment.

Poor: Slow response can be expected. The soils have limited capability for establishment and support of vegetation. Special management practices may enhance the rate of establishment. At least several years will be required to establish acceptable cover.

RECLAMATION

Considers revegetation potential plus effort needed and anticipated success for restoring contours to near pre-existing condition.

Attainable - Little or Moderate Difficulty: Revegetation potential is fair or good. Slopes are less than 40 percent. Cutslopes are usually not excessively high and fill material can usually be replaced on cuts with a crawler tractor.

Attainable - Difficult: Revegetation potential is fair. Slopes are greater than 40 percent. Cutslopes are higher and larger volumes of material must be replaced on them. Equipment such as trackhoe or dragline may be needed. Special soil handling techniques such as replacement of end hauled material may be required.

APPENDIX C-5

Summary of Current Management Direction
as itemized by:

Spread Creek - North Gros Ventre
Planning Unit Environmental Statement and Land Use Plan
Bridger-Teton National Forest
U.S.D.A. Forest Service
1974

and

Proposed Management Prescriptions
as itemized by:

Bridger-Teton National Forest
Proposed Land and Resource Management Plan
U.S.D.A. Forest Service
1986

The following summarizes the current and proposed Forest Service management direction within the analysis area of the Sohare Creek Unit Exploratory Oil Well No. 1-35 EIS.

CURRENT MANAGEMENT DIRECTION

Current management directions applicable to the proposed drilling action area are as follows:

Recreation

Meet projected demands for dispersed type recreation opportunities for public enjoyment of the unit. Coordinate recreation policies with the National Park Service and adjacent National Forests to avoid needless differences and to provide efficient public service.

Wildlife

Manage habitat to support optimum population levels of animals, birds and fish. Give special emphasis to maintaining and enhancing big game habitat and those native species which may be threatened or endangered.

Roadless - Undeveloped Areas - Wilderness

Designate portions of inventoried undeveloped areas #366, 368, 369, 370, 380 and 381 as a special Elk Management Unit containing the primary elk summer range within the planning unit. The use of this area by motor vehicles will be closely regulated. Special emphasis will be given to wildlife and particularly big game habitat. No land in the planning unit will be studied for wilderness designation under this land plan.

Minerals

Plan valid mineral-gas-oil exploration and extraction activities to minimize the adverse visual impacts and prevent degradation of water quality. Cooperated closely with Department of Interior agencies having mineral leasing responsibilities.

Visual Resource

The basic character of northwest Wyoming forest lands should be kept dominant and man-made alterations held subordinate.

Fire Management

Minimize resource damage from uncontrolled fires, considering cost versus resource values. Control all wildfires at ten acres or less, except where deviations are authorized in an approved fire management plan.

Make use of fire as a tool for maintaining natural diversity in plant communities. Give special emphasis to the prescribed fire to regenerate aspen stands on big game winter ranges.

Watershed and Soils

Plan and execute resource uses and activities within the constraints of soil capabilities and hazards. Prevent accelerated soil erosion. Prevent or promptly abate water pollution and adhere to state and federal water quality standards.

Air Quality

Maintain the current high quality of air throughout the planning unit. Conduct prescribed burning under favorable conditions for rapid smoke dispersal. Cooperate with the state and other agencies charged with air monitoring and quality control. Prevent air and noise pollution in and near areas of concentrated public use.

Historical, Archeological and Natural History

Identify, protect and/or salvage, and interpret significant sites through cooperation with other organizations and interested groups.

Livestock Grazing

Manage the forage resource for optimum benefits/cost within the constraints imposed by the requirements of esthetics, soils, timber regeneration, big game range use and certain recreation activities.

Insects and Disease

Primary reliance for control of bark beetle epidemics and other insects and diseases will be through harvest of mature and overmature stands where this can be accomplished without unacceptable environmental effects. Because much of the timber in the planning unit is in areas unsuitable and

unavailable for harvesting, this method of control can only be partially successful.

Direct chemical/biological control methods may be used where necessary to protect high values. Great care in selection and application of chemicals needed in insect and disease control is essential.

Timber Management

Manage lands classified as suitable for timber management for sustained production within the capabilities of the lands, and in a way compatible with all other uses and activities.

Special Land Uses

Permit use of National Forest lands in furtherance of subdivision development only where such use cannot reasonably be accommodated on private lands, and then only where environmental analysis show the use will not create significant conflicts with National Forest management objectives.

PROPOSED MANAGEMENT PRESCRIPTIONS

Proposed management prescriptions applicable to the proposed drilling action area are broadly defined as follows:

Management Prescription 2A (Sohare Creek drainage, including the proposed drill site and upper segments of access road alternatives) - "Management emphasis is for Primitive recreation experience in areas outside of wilderness. Management perpetuates essentially natural conditions and remoteness from mechanized human activities. Management activities are integrated in such a way that current human use leaves no permanent or long lasting evidence. Motorized activities are prohibited, except for those allowed under minerals/energy exploration and development. Visual resources are managed so that management activities are not visually evident. Minerals and energy exploration and development allowed when in compliance with BLM regulations. Leasing is permitted, exploration and development must be compatible with other resource objectives. Compatibility is achieved by use of mitigating measures developed in the NEPA process."

Management Prescription 7 (North end of proposed access route in the Kettle Creek and Spread Creek drainages) - "Management emphasis is on conservation and habitat for recovery and maintenance of viable grizzly bear populations in Management Situation 1 areas outside wilderness, and Management Situation 2 areas. The goal is to maintain or improve essential habitat for recovered (viable) populations of grizzly bear to minimize potential for and resolve bear/human conflicts. Mineral and energy leasing exploration and development are not allowed until the grizzly bear populations of the respective area are classified as recovered."

Management Prescription 12 (South end of roading alternatives in the Cottonwood Creek drainage) - "Management emphasis in this area is on habitat for Management Indicator Species, big game, and Primitive and Semi-Primitive recreation opportunities. The goal is to provide habitat capability and escape cover for big game species; and also maintain Primitive and Semi-Primitive recreation opportunities and outfitter hunting to serve public needs. Minerals and energy exploration and development are allowed when in compliance with BLM regulations. Leasing is permitted. Exploration and development must be compatible with other resource objectives. Compatibility is achieved by use of mitigating measures developed in the NEPA process."

APPENDIX D

H_2S Contingency Plan

CONTINGENCY PLAN

RECEIVED

APR 06 1987

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ROCK SPRINGS, WYOMING

AMOCO PRODUCTION COMPANY
P. O. Box 1400
Riverton, Wyoming 82501

ACTION PLAN FOR ACCIDENTAL RELEASE OF H_2S

(This plan is subject to updating)
March 1987

I. PURPOSE:

The purpose of this plan is to safeguard the lives of the public, contract personnel, and company personnel in the event of equipment failures or disaster during the drilling of formations which may contain Hydrogen Sulfide Gas (H_2S).

AMOCO PRODUCTION COMPANY has specified materials and practices for the drilling of this well to protect the safety of all concerned. However, as a precautionary measure this contingency and evacuation plan has been prepared to further assist the safety of all concerned.

II. DESCRIPTION OF HYDROGEN SULFIDE GAS:

H_2S is a colorless gas which smells similar to rotten eggs in low concentrations rations. I large concentrations however, the sense of smell may be paralyzed rapidly. H_2S is an extremely toxic gas that must be treated with extreme care to prevent injury to people. H_2S is heavier than air (specific gravity = 1.19) and on still days tends to accumulate in low places. This accumulation could build up and lead to dangerous concentrations. However, if the H_2S gas is warmer that air, it will tend to rise until cooled off and could affect workers above the escaping source.

The toxicity of H_2S is as follows:

Period of Exposure

Prolonged exposure - no adverse effects	10 PPM
Over 1 hour could be hazardous	150 PPM
Possibly fatal in less than 1/2 hour	300 PPM
Fatal in a few minutes	700 PPM

III. TREATMENT OF HYDROGEN SULFIDE POISONING:

A. Remove the patient to fresh air, call physician or ambulance if possible.

B. If breathing is labored or has ceased, give artificial resuscitation immediately. Continue until physician is available, even if person appears to be not breathing. Should disaster conditions make it impossible to move to fresh air, keep on your mask and use resuscitator on patient.

C. After breathing commences, continue victim on oxygen until arrival at hospital. O_2 helps eliminate H_2S from the blood stream.

D. Prevent shock.

E. Get patient to a physician as soon as possible.

PERMT6/M1

IV. EQUIPMENT REQUIREMENTS

A. General:

All equipment to be exposed to H_2S shall be built to NACE Standard MR-01-75, or Amoco specifications if Amoco specifications are more stringent.

B. Blowout Preventer Requirements:

All BOP body and parts (excluding rams) shall be constructed of a carbon steel or low alloy steel with an HRC 22 maximum hardness. Rams shall be built out of low alloy steels (i.e. AISI 4130 or like). The BOP will have the necessary certification stating it is acceptable for an H_2S environment. Copies of this will be provided on location by the contractor toolpusher.

On initial installation the blowout preventer stack will be tested to the full working pressure rating or working pressure rating of the last casing spool, whichever is less. It will be tested routinely thereafter, not to exceed 30 days. The stack will also be tested any time a seal has been broken, a leak experienced, or a known H_2S bearing formation is to be drilled.

C. Drill String Requirements:

All drill string components shall be to API specifications for tubular goods in controlled environments. Typically, Grade E drill pipe will be used. Grade G or X drill pipe may also be used when needed. All components will be inspected to IADC critical service specifications prior to running in the well. Corrosion will be monitored by coupons.

D. Choke Lines and Kill Manifold:

Choke lines and kill manifold shall be constructed of ASTM 106 grade B or A-53 grade B.

E. Casing and Wellhead Equipment:

Casing shall be constructed to API requirements for sour gas wells. The casing to be run will be K-55, C-75 type 2, L-80 or SS-95.

The 13-3/8" casing will be set at approximately 3000 feet in the Cody formation, and cemented with approximately 400 sxs Class G or H from 2300-3000' and 1100 sxs Lite Cement from 2300-Surface.

After running and cementing the 13-3/8" casing, the BOP's will be nippled up and pressure tested to the full working pressure rating or the working pressure rating of the last casing spool, whichever is less. Prior to drilling out, the casing string will

be pressure tested to 1000 psi, or to an equivalent pressure of 0.2 psi/ft of depth, or to 80% of casing burst strength, whichever is greatest.

Wellhead equipment will be constructed to Amoco specifications. From the tubing head up, all valves shall have stainless steel balls and seats with monel stems, which complies to NACE 1 trim. Valve bodies to be made from carbon or low allow steel with HRC 22 maximum. All welds will be x-rayed and stress relieved.

V. SAFETY AND MONITORING EQUIPMENT:

A. Gas Monitoring Equipment:

1. A continuous H_2S monitoring system with four or more H_2S detection heads will be in operation. These monitors will be located at: 1) rig floor, 2) bell nipple, 3) shale shaker, 4) pump room. These units will be monitored in the mud logger's trailer and/or the dog house. Each unit will be set to trigger a blinking light on the rig floor should the amount of H_2S reach 100 PPM, and to trigger an alarm siren @ 20 PPM.

   Any time it is necessary to deactivate the alarm (If H_2S is continuously present) a trained operator or H_2S Supervisor will monitor the detection system.

2. Hand sampling gas detectors will be used to check areas not covered by automatic monitoring equipment.

3. A mud duck will be installed in the mud logger's trailer with a probe at the flowline, which will monitor the concentration of any entrained H_2S in the drilling fluid.

B. Safety Equipment:

1. The following safety equipment will be available:

   Escape packs:

   1-5 minute work escape pack in the derrick
   6-5 minute work escape packs on the rig floor
   2-5 minute work escape packs at various points along mud tanks
   1-30 minute pack in each trailer (2 in mud loggers' trailer)
   1-30 minute pack at bottom of steps
   1-30 minute pack in mud shed
   1-30 minute pack in tool shed
   2-30 minute packs in dog house

   Total: 10-30 minute packs
   12-5 minute packs

Cascade System:

10-300 cu. ft. cylinder air cascade
2-5 outlet manifold on floor (1 each side)
2-5 outlet manifolds on mud tanks
12-line masks (same as 5-minute packs)
1500' low pressure air line hose with quick connects
2-briefing areas (minimum)

Other Equipment:

4 - wind socks
36 unit - first aid kits
1 - oxygen resuscitator with spare cylinder
2 - flare guns with shells
1 - stretcher
1 - combustable gas monitor
2 - safety belts with safety lines

When the 13-3/8" surface casing is run and cemented and 1000' above the 9-5/8" casing point, ventilation fans will be placed on the rig floor and under the rig floor.

NOTE: Respirators shall comply with OSHA standards, 1910.134, Respiratory Protection.

This equipment is available for persons normally on location. This includes the five man crew, toolpusher, Amoco drilling supervisor and mud loggers. Maximum number of people to be on location during normal drilling operations should range from ten to twelve.

2. Two areas on location will be designated as **BRIEFING AREAS.** The one that is upwind from the wellbore will be designated as the **"SAFE BRIEFING AREA".** The **"SAFE BRIEFING AREA"** will be recognized by the positioning of the **SAFETY** trailer in this area.

3. The H_2S **SAFETY** trailer provided by a safety contractor will contain the equipment listed in V-B.1 (above) and will have a wind sock or streamer to indicate wind direction.

4. A second wind sock or streamer will be located at the end of the catwalk and visible from the rig floor.

5. A condition warning sign will be displayed on location and at the entrance of location regarding current operating conditions.

6. The emergency procedure (attached) will be kept on the rig floor, contract toolpusher's trailer, Amoco's trailer and in safety trailer.

7. Two barricades will be available to block entrance to location should an emergency occur.

8. An external communication system should be installed in Amoco's trailer, mud logger's unit and on rig floor.

9. An internal communication system should be installed between company trailer house, contract toolpusher's quarters, mud logger's unit, rig floor, shale shaker, mud mixer area and choke manifold.

10. An undulating high and low pitch siren will be installed.

VI. CREW TRAINING AND PROTECTION

A. Blowout Prevention Drills:

On bottom drill and trip drill training will be held with each crew until proficient in closing the well in. Drills will be held on a regular basis thereafter, with a least one drill per crew with the Drilling Supervisor or contract toolpusher triggering the alarm. Reaction time will be checked from the time the alarm goes off until the well is simulated closed in. Closing time should be under two minutes.

B. H_2S Training and Drills:

All personnel on site will be trained in H_2S safety when the 13-3/8" surface casing is run and cemented. In addition, periodic drills will be held for all personnel. All personnel on site will be certified in H_2S safety and will maintain a valid certification. An H_2S safety company will be rigged up at least 1,000' before and H_2S bearing zones are encountered and will be on site 24 hours per day until completion or plugging of the well.

Training will include: the correct use of the fresh air breathing equipment, wind socks, safety ropes, harnesses, and oxygen resuscitator with instruction on artificial resuscitation and on the emergency procedure.

H_2S drills will be held periodically. The Amoco representative, along with the toolpusher, shall plan and activate drills. They will activate the H_2S alarm without warning and participate in the drill. The crew will proceed to put on a mask and secure well as per posted drilling procedures.

C. Circulating Through Choke:

A non-emergency situation can exist where it may be necessary to circulate wellbore fluids containing H_2S gas through the choke manifold system. These situations could be gas cutting off the mud, a gas bubble from bottom up after tripping or a fluid

influx from the mud hydrostatic being underbalanced to the formation pressure. In these cases, the well is still under control and while the bubble is circulated out and/or the appropriate mud weight for the system is obtained, it may be necessary to flare H_2S gas through the choke manifold. Steps for ignition of this flare and insuring it stays lit will include the following:

1. The Amoco representative will designate a person, usually a member of the drill crew, to be responsible for maintaining a pilot light in the flare pit.

2. A pilot light for the flare ignition will generally be a burning 5 gallon bucket of diesel. If unusual or safety considerations warrant its use, an automatic ignitor system may be employed.

3. A minimum of two (2) flare guns will be on location. One each for Amoco drilling foreman, and H_2S safety hand. It will be the responsibility of the Amoco representative or toolpusher on location to insure the ignition of the flare is handled in a safe and prudent manner.

VII. MUD ADDITIVES:

A water-base mud system will be used. At approximately 500 feet above the expected hydrogen sulfide formation (Phosphoria) the system will be treated with Zinc Chelate. For normal drilling operations, a concentration of 1-2 ppb will be maintained in the system. The mud will be maintained at a pH of 10.5 or above from this point to total depth.

VIII. LOCATION OF RESIDENTS:

None within a two (2) mile radius.

IX. WELL TESTING PROCEDURES:

All equipment, including drill string and tubing string members and tools, surface test units, and miscellaneous related testing equipment, shall conform to NACE Standard MR-01-75, or Amoco specifications if Amoco specifications are more stringent.

X. EMERGENCY EVACUATION PLAN:

See Attachment

X. EMERGENCY EVACUATION PLAN

NOTE: This attachment shall be posted on the bulletin board contained in the dog house, with extra copies contained in the contract toolpusher's trailer, Amoco trailer and in the safety trailer.

Designation of Responsibility:

In order to assure the proper execution of this plan, it is essential that one person be responsible for, and in complete charge of, implementing these procedures. Therefore, responsibility shall be designated in the following order, depending on who is on location:

1. Amoco Production Company's Representative (Drilling Foreman)

2. Contract Toolpusher

Definition of Warning Signs:

Condition: Green - Normal Operations

Condition: Yellow - Potential Danger - Caution

Cause for Condition:

1. Circulating
2. Trip gas after trips
3. Circulating gas out on choke
4. Poison gas present, but below threshold levels

Condition: Red - **EXTREME DANGER**

Cause for Condition:

1. Uncontrolled Well
2. Poison gas present above threshold levels

Emergency Procedures:

Condition Yellow:

1. Check safety equipment and keep it with you
2. Be alert for a change in condition warning sign
3. Follow instructions

Condition Red:

Upon release of potentially hazardous volumes of hydrogen sulfide gas, this program shall be initiated immediately:

1. Set off alarm. Evacuate all persons off location to "**safe briefing area**" that is upwind. Check that all persons are present. If not, proceed with evacuation from hazardous area in the following manner:

   a. Two persons, re-enter hazardous area with air packs and each attached to an assistant via safety line The assistant shall also be wearing respiratory equipment but outside of the hazard area.

b. Locate and evacuate all other persons in hazardous areas to safety briefing area.

c. Proceed with emergency first aid to all injured. Call for ambulance and alert hospital that victims are being transported, giving estimated time of arrival.

MEDICAL PERSONNEL

St. John's Hospital----------307-733-3636
Jackson Hole, Wyoming

Hospital Adminstrator, Dale Morgan

AMBULANCE----------307-733-3636

LIFE FLIGHT----------307-733-2435

JACKSON HOLE AIR AMBULANCE----------307-733-6328

2. Locate, define problems and proceed with emergency shut-in procedures per Amoco Production Company Blowout Drill Procedure.

3. Stay in "safe briefing area" unless instructed to do otherwise. Continuously monitor air quality in briefing area.

4. Only enter hazardous area with adequate air supply and attended by someone with a safety rope.

5. Call Company personnel in the following order, until one is contacted. Inform him of the problem and what actions have been taken. It is then his responsibility to contact his supervisor.

Name	Office	Residence
D. S. Archambault	307-856-8057(mobile)	307-332-3023
D. R. Adams	307-856-8111	307-856-3653
J. G. Juve	307-856-8111	307-856-0204
B. A. Beresik	307-856-8111	307-856-1254
B. H. Balthrop	307-856-8111	307-856-0070
E. A. Pierce	307-856-8111	307-856-2663

6. Notify the appropriate agencies and law officers that an emergency situation exists and help is needed.

PERMT6/M10

LAW ENFORCEMENT AGENCIES

SHERIFF'S DEPARTMENT ----------307-733-2331

SHERIFF, Teton County
Roger Millward ----------307-733-2331

HIGHWAY PATROL ----------1-800-442-9090
Cheyenne Dispatch

WYOMING OIL & GAS BOARD

Oil & Gas Conservation Commission
Casper, Wyoming ----------307-234-7147
(after hours) 307-235-6449
or 307-265-2776

BUREAU OF LAND MANAGEMENT

BLM (Oil and Gas Operations)
Rock Springs, Wyoming ----------307-382-5350

FIRE DEPARTMENT

Jackson Fire Department ----------307-733-2331

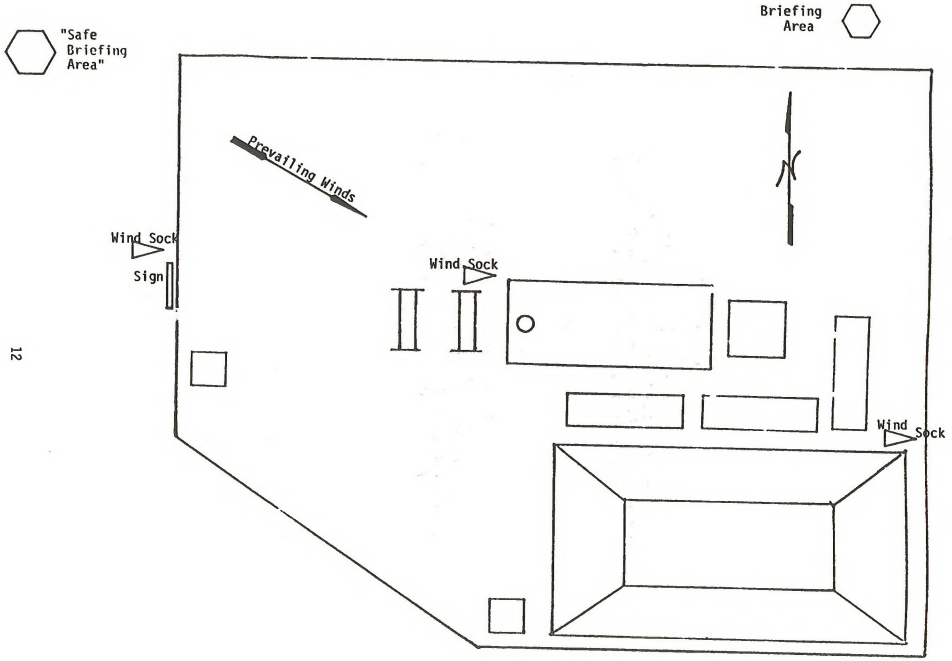
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

Environmental Quality, Air Quality Division
Lander, Wyoming
Lee Gribovicz ----------307-332-3144

7. The State Police shall contact residents in the one (1) mile danger zone, and start evacuation with those in the down wind direction of the rig.

8. In the event that a blowout should occur, the decision regarding ignition of the escaping gas will be made by the Amoco representative on location after consultation, if possible, with the appropriate supervisor or management personnel listed previously. However, if the seriousness of the situation does not allow time for consultation, the Amoco representative on location has the authority to make the decision to ignite as a last resort where it is clear that human life and property are in jeopardy and/or the chance of controlling the well under the prevailing conditions are very remote.

9. Meet with appropriate agencies and law officers as soon as practical to brief them on the situation and coordinate evacuation efforts.


"Safe Briefing Area"
Briefing Area
Prevailing Winds
Wind Sock
Sign
Wind Sock
Wind Sock

APPENDIX E

Biological Assessment
of the Effect of Sohare Unit No. 1-35
Exploratory/Production Well and Road Access on
the Whooping Crane and Grizzly Bear

and

Addendum To

Biological Assessment
On Quantitative Analysis
Of the Effect of Sohare Unite No. 1-35
Exploratory/Production Well and Road Access on
the Whooping Crane and Grizzly Bear

BIOLOGICAL ASSESSMENT

OF THE EFFECT OF SOHARE UNIT NO. 1-35

EXPLORATORY/PRODUCTION WELL AND ROAD ACCESS ON

THE WHOOPING CRANE AND GRIZZLY BEAR

JACKSON AND BUFFALO RANGER DISTRICTS

BRIDGER-TETON NATIONAL FOREST

BY

FLOYD A. GORDON
WILDLIFE BIOLOGIST

AND

DAVID GRIFFEL
WILDLIFE BIIOLOGIST

APRIL 21, 1987

TABLE OF CONTENTS

		Page
I	INTRODUCTION	1
II	DESCRIPTION OF PROPOSAL	1
III	STANDARDS FOR BIOLOGICAL ASSESSMENT	3
IV	IDENTIFICATION OF LISTED, PROPOSED, AND SENSITIVE SPECIES	3
V	IDENTIFICATION AND DESCRIPTION OF ESSENTIAL HABITAT	4
VI	ANALYSIS OF THE EFFECTS (CUMULATIVE) OF THE PROPOSED ACTION	5
VII	DETERMINATION OF EFFECTS	10
VIII	RECOMMENDATIONS	11
IX	SUMMARY	13
X	REFERENCES	13
XI	APPENDIX	15

FIGURES

1. Project Location Map.
2. Unit Area and Road Access Map.
3. Grizzly Bear and Whooping Crane Distribution Map.
4. Habitat Diversity Units Map.

BIOLOGICAL ASSESSMENT
SOHARE UNIT NO. 1-35 EXPLORATORY WELL

JACKSON AND BUFFALO RANGER DISTRICTS
BRIDGER-TETON NATIONAL FOREST

I INTRODUCTION

On January 22 and 23, 1986, a meeting attended by BLM and Forest Service representatives, the Endangered Species staff of the Fish and Wildlife Service, biologists from the Wyoming Game and Fish Department and representatives of Rio Verde Engineering and Hayden-Wing Associates, was held at the Supervisors Office in Jackson, Wyoming. One of the purposes of the meeting was to discuss the requirements of T & E species within the Sohare area and the possible effects oil exploration and other ongoing activities would have on a listed species. The Fish and Wildlife Service and others in attendance concurred that a cumulative effect analysis should be completed for this immediate project as part of the required biological assessment. It was also stressed by the Fish and Wildlife Service that management emphasis should be on conservation of the species.

This Biological Assessment follows the direction provided in Forest Service Handbook (FSH) 2672.4 and complies with the requirements of the Endangered Species Act of 1973. It is intended to ensure that Forest Service actions do not contribute to the loss of viability of any native plant or animal or adversely modify their habitat but provide for the conservation of the species. The Biological Assessment is the means of conducting a review of a proposed activity and documenting the findings. It provides a process and standard by which to ensure that threatened and endangered species receive full consideration in the decision process.

II DESCRIPTION OF PROPOSAL

The Amoco Production Company of Riverton, Wyoming, has made application to drill an 11,050 foot exploratory oil well on the Jackson Ranger District of the Bridger-Teton National Forest. The proposed project is located in Sohare Creek, (SW 1/4, of Section 35, T43N, R112W) within Teton County, Wyoming. Figure 1 shows the project location.

Amoco's proposed Sohare Creek Exploration Well is classified as a wildcat well since it would be drilled in the unproven territory of the Sohare Creek Exploratory Federal Unit. Three previous wells were drilled inside this Unit, one of which showed marginal quantities of gas.

Five alternatives to access the drill sites are under consideration, (Figure 2). Three alternatives call for vehicle access for which approximately three to fourmiles of new road construction will be required. Two alternatives providefor helicopter access.

Two road access routes have been selected for consideration. Alternative A (Northern Access) would begin where road #017 ends in Section 23, T43N, R112W, and would access the drill site via the Kettle Creek drainage and the South Fork of Spread Creek and the Flagstaff roads.

Approximately 1.6 miles of this route would follow a reclaimed oil well access road and would require reconstruction.

Access route Alternatives B and C (Southern Access) would begin at the end of the Cottonwood Creek Road (#032) in Section 18, T42N, R111W, and would access the drill site by two different routes via Sohare Creek. Road reconstruction would not be considered under the proposed Alternative D-1 or D-2 helicopter options.

Construction and drilling is proposed to start in the summer of 1988, and is expected to take approximately 120 days to reach the 11,050 foot target. Drilling would start after the mean denning date established for grizzly bears which is November 15 and would continue for 120 days, or until approximately March 15, 1988.

If the well is found to be dry, the hole would be plugged and abandoned. All road construction would be reclaimed and returned to pre-drill conditions. Reclamation would be completed during the summer of 1988.

If the well is determined to be a producer, several steps would be taken to complete or develop the well. This would include the casing of the well, perforating of the reservoir, installation of the control head or pumping unit, and the construction of a battery of tanks for storing the oil. Upon completion of the well development, the well would be put into production. Oil or gas reserves would be brought to the surface, placed in storage tanks, and removed from the site by truck. Access roads to the field would remain in place for the life of the field (20 to 30 years), but would remain closed to the general public. Maintenance workers would use the roads several times each day and would reach the well site in a tracked snow vehicle during heavy snows. At all other times, the access roads would be plowed.

The proposed drillsite, access routes and surrounding lands encompass portions of the Buffalo and Jackson Ranger Districts and are located in habitats occupied by several high interest wildlife species. Habitats in the area serve as elk spring, summer and fall range for the Jackson herd. It is a major migration corridor for other elk in the herd that winter along the Gros Ventre River and summer in the Teton Wilderness. This elk herd is of national importance. Other wildlife are also present, including species on the Federal Threatened and Endangered Species List and big game such as deer and moose. These lands together with adjacent National Forest, National Park and the National Elk Refuge lands are recognized as the premier outdoor recreation area

in the United States. Three outfitter camps are located within the area that would be affected by this proposal.

III STANDARDS FOR BIOLOGICAL ASSESSMENT

To meet Forest Service Manual requirements (FSH 2672.42) this biological assessment includes the following evaluation standards: 1) a list of identified, proposed and sensitive species known or expected to be in the project area or that could be affected by the project; 2) an identification and description of all occupied and unoccupied habitat recognized as essential for listed species recovery; 3) an analysis of the effects of the proposed action on listed species or their occupied habitat or on any unoccupied habitat required for recovery; 4) a discussion of cumulative effects resulting from the planned project in relationship to other nearby projects; 5) a determination of effect on a species; 6) recommendations to protect and conserve the species; 7) a list of references.

IV IDENTIFICATION OF LISTED, PROPOSED, AND SENSITIVE SPECIES

The following listed species are known to occur within the vicinity of the Sohare Creek Unit Proposal (Figure 3).

WHOOPING CRANE	Grus americana	Endangered
GRIZZLY BEAR	Ursus arctos horribilis	Threatened

In 1982, 1983 and 1984, two areas in the vicinity of the Buffalo River Valley, encompassing about 6 square miles, were occupied by a female whooping crane from the Greys Lake National Refuge in Idaho (personal communication, Dave Lockman, Wyoming Game and Fish Department). This crane was not observed on the Teton Forest in 1984, but summered on the Forest in 1982 and 1983 in the Spread Creek drainage. During 1982-84 she spent part of the spring on private lands in Buffalo Valley, adjacent to the Forest (Wyoming Game and Fish Department Wildlife Observation System). No whooping cranes were observed in the Buffalo Valley or on National Forest lands in 1985 or the spring of 1986.

The proposed drill site and access roads lie outside of areas where observations of whooping cranes use have been made (Wyoming Game and Fish Observation System). This project will not affect either the crane or their use of the habitat.

The endangered Bald Eagle Haliaeetus leucocephalus and Peregrine Falcon Falco peregrinus are present within Jackson Hole but they are outside the immediate area under consideration. Peregrine falcons have been observed along the Gros Ventre River southwest of Kelly. A bald eagle nesting area is located along the south shore of Lower Slide Lake on the Gros Ventre River. Road access under Alternative B (Southern Access) would occur along an existing road about 2,000 feet from the nesting area. Neither the bald eagle or the peregrine falcon are

expected to be affected by this proposal. No proposed or sensitive plants or animals are known to be present within the project area.

The listed speci that can be affected by the Sohare proposal is the Grizzly Bear. Following is an overview of essential habitat.

V IDENTIFICATION AND DESCRIPTION OF ESSENTIAL HABITAT

On the Bridger-Teton National Forest, grizzly bears occur north of the Spread Creek-Gros Ventre River hydrographic divide on the Buffalo Ranger District and south of the Spread Creek-Gros Ventre River divide within the Fish Creek Drainage on the Jackson Ranger District. The northern access route to the proposed Sohare project (Alternative A) is located within the Pacific Creek-Blackrock Bear Unit. Grizzly bears are present yearlong in this area. The density of bears present in this area is considered to be lower than for the Thorofare Bear Unit and adjacent areas of the Yellowstone Ecosystem (Larry Roop, Wyoming Game and Fish Department, personal communication). The access route falls within lands managed under Grizzly Bear Management Situation 1, 2 and 3 direction as defined in Guidelines For Management Involving Grizzly Bears In The Greater Yellowstone Area, 1979.

The proposed Sohare Unit drill site, and Alternatives B and C road options are south of the area identified as occupied habitat. Individual bears, however, have been observed south of Management Situation 1, 2 and 3 designated areas (Wyoming Game and Fish Department Wildlife Observation System). Most of the observed use by grizzly bears is to the northeast of the proposed well site. Denning has been observed in the area but appears to be of limited occurrence.

Seasonal patterns of habitat and forage use by grizzly bears have been summarized in Endangered, Threatened, And Sensitive Plants And Animals Species And Habitat On The Bridger-Teton National Forest, Wyoming, 1974. A description of forage availability within the nonwilderness portion of the Pacific Creek-Blackrock Bear Unit follows:

> Within occupied grizzly habitat, but north of the area affected by the Sohare proposal, is the Buffalo Valley moose winter range. Up to 150 moose are present each winter. Elk make limited use of the valley in winter. within the area affected by the Sohare proposal are low winter densities of moose.
>
> As spring greenup occurs bears feed on herbaceous vegetation (grasses, sedges and forbs) associated with sidehill parks/valley grasses and riparian areas along the primary streams. During spring (late March, April and early May) grizzlies emerge from their winter dens and make use of whitebark pine nuts, scavenge on carrion or prey on winter weakened ungulates.

Major elk calving areas are present in Lower Spread Creek, Buffalo River, Gros Ventre and Fish Creek drainages. These calving areas, however, with the exception of the Gros Ventre, lie outside of the area affected by this proposal.

During summer (June, July and August) bears move to areas where succulent herbs, starchy roots and pocket gophers are available following the desiccation of vegetation on southfacing sidehill parks and dry meadows. In the fall, bears make considerable use of riparian sites, mountain meadows, and, when available, whitebark pine seeds. Predation on weakened or vulnerable big game may occur when opportunities present themselves or bears will scavenge on offal made available during the hunting season.

VI ANALYSIS OF THE EFFECTS (CUMULATIVE) OF THE PROPOSED ACTION

The following analysis describes the short-term, long term, and additive (cumulative) effects of ongoing activities on the grizzly bear. Activities include timber management, oil/gas exploration, road construction, associated road traffic, and recreational use.

Grizzly Bear

The proposed drilling project and access roads lie within and adjacent to an area identified as habitat essential to the grizzly bear. This project has the potential to directly affect either bears or their habitat or contribute through cumulative effect, additional impact on the bear above that presently occurring.

This analysis focuses on the possible additive effects (cumulative) that the project and other existing activities have on the recovery of the grizzly bear and its conservation. Elk and bears share in common the need for secure habitats. The following evaluation will depend on an analysis that was developed for use with elk. This is necessary as the data base for use with the Greater Yellowstone Area Grizzly Bear Cumulative Effect Model is not yet available for completing such an analysis. The following analysis, however, when properly applied to the existing proposal should be of assistance in helping to determine the effect of this project on the bear. A review of the effect of the well sites and road access on the grizzly bear will be described.

This analysis is based on four factors which determine elk habitat effectiveness: 1) Open road density, 2) Traffic levels on the roads, 3) Forage/cover ratios, and 4) Juxtaposition of forage and cover. These four factors are used to calculate an Elk Habitat Effectiveness rating (EHE) which provides an index of the relative ability of the habitat to hold elk during the summer and fall seasons. A rating of 100 indicates an ideal forage/cover ratio with good juxtaposition and no open roads. Lower values reflect nonideal forage/cover ratios and juxtaposition, some open roads and differing levels of

traffic on the roads. Additional information on determining elk habitat effectiveness can be found in Estimating Effects of Habitat Changes On Potential Elk Use In Western Wyoming, and Elk-Timber Relationships of West-Central Idaho.

The basic unit of this analysis is the Diversity Unit, and area of land of approximately the size used by elk as summer home range. A Habitat Unit, an area of land of sufficient size and habitat structure relating to the more mobile species such as elk or bear, is made up of 5 to 6 individual Diversity Units. Maps and data used for this analysis are on file at the Supervisors Office in Jackson. Diversity Units 1, 2, 3, 4, 5, and 6 (Habitat Unit 5-2) and Diversity Unit 8 (Habitat Unit 5-4) will serve as the analysis area for determination of cumulative effects on the bear (Figure 4).

Tables 1, 2, 3 and 4 display Elk Habitat Effectiveness ratings (EHE) for the analysis area. Tables 1 and 2 display seasonal habitat effectiveness for the following time frames: 1940's, 1960's, 1970's, mid-1980's.

In the 1940's access roads were predominantly jeep trails. Summer use was low with moderate vehicle use occurring during the fall hunting season. In the late 40's the Hatchet road was constructed from the Buffalo Valley for access to an exploratory well site south of Skull Creek Meadows. Habitat Effectiveness ranged from EHE of 80 (summer) to EHE of 76 (fall) during this period. The reduction in EHE in fall is related to increased levels of motorized traffic during hunting season which reduces habitat effectiveness. From the 60's to the mid 80's, habitat effectiveness continued to decline as more miles of roads were constructed for timbering and oil/gas exploration and less secure habitats were available. Table 1 (Appendix) displays the history of road building, road closures, timber sales and oil/gas exploration in occupied grizzly habitat.

Currently the analysis area has an EHE of 63 (summer) and an EHE of 69 (fall), down from the predevelopment era prior to 1960's.

During the 70's gates were installed on a number of local specified roads to control vehicle access and provide increased security for resident elk during the hunting season. Their effectiveness was dependent on the gates being closed to motorized vehicles. Continued administrative and commodity use behind these closures during summer and early fall has prevented an increase in habitat effectiveness.

Tables 3 and 4 display the effect of the proposed action on habitat effectiveness by season. Alternative A, and Alternatives B and C, show a slight reduction in EHE from the current situation. This is due to the relatively low amount of new road construction and associated activity that will occur with this proposal. Habitat effectiveness resulting from helicopter access is also considered to have an effect similar to that of the road access options.

Alternative A, would have the greatest potential for impact as the main access road will pass through essential grizzly bear habitat. When this proposal is viewed in light of the current management situation, the potential for further affecting the grizzly bear is considered significant.

Habitat Types within the analysis area were used to determine the effect of the project on habitat value by season.

In January of 1984, the Yellowstone Ecosystem Subcommittee of the Interagency Grizzly Bear Committee, (in the **Cumulative Effects Analysis Process** for the **Yellowstone Ecosystem**) developed habitat value coefficients for different combinations of habitat types and cover types. Habitat values ranged from a maximum of 1.00 to a minimum of 0.00. Habitats were rated .00-.25 poor, .26 .50 fair, .51-.75 good and .76 to 1.00 excellent (**Forest Habitat Types of Eastern Idaho-Western Wyoming, 1983 by Steele and others** and **Teton National Forest Soil Survey, 1983**). Habitat type and soil survey maps are on file at the Supervisor's Office in Jackson.

Alternative A which has the potential to affect the grizzly and it's habitat were evaluated by season. During spring, riparian areas and southfacing nonforested slopes were rated good to excellent as they provide succulent vegetation. The main road along the south Fork of Spread Creek and Kettle Creek accessed the well sites through these important habitats. Other habitats appeared to be of limited importance to bears as they do not provide adequate amounts of readily available foods. Bear use of succulent vegetation is limited in spring to a relatively small portion of the overall area. Activity during the spring could possibly deprive bears of the only available source of food during this period.

During summer, as succulent vegetation becomes available away from the primary riparian areas, bears are able to forage in these isolated areas throughout the Spread Creek Drainage. As a result, the riparian zone along the South Fork of Spread Creek and Kettle Creek is not as important as a source of forage as during early spring. As we have seen, human activity along portions of South Fork Road reduces the effectiveness of this habitat. Other nonriparian habitats during this period have a habitat value of poor or fair.

In the fall the habitats that earlier ranked poor to fair have increased in value. For example, habitats that contain big huckleberry assume greater importance in all cover types. Grizzly bears feed on berries during the fruiting season. Another key habitat for bears is one that provides whitebark pine nuts. Both these habitats are present throughout the analysis area. Although the proposed road may access some whitebark pine sites, the relative amount of whitebark pine that may be disturbed and the potential of this on project appears to be of little short term significance. This is particularly true if important forage sites adjacent to the access route are available for use by bears.

TABLE 1. HABITAT EFFECTIVENESS OF THE ANALYSIS AREA DURING THE SUMMER AND FALL

Area (DU)	Acres	SQ. Mi	For	Cov	Ratio		Den	Length
Pre-1960's								
62204	97.2	32059	30145	52:48	F/P	.5	43.8	80
1960's Road Building/Timber Harvest/Oil Drilling								
62204	97.2	35405	26799	57:43	P/F	.9	88.4	68
62204	97.2	36792	25412	59:41	P/F	1.1	105.8	64
62204	97.2	37172	25032	60:40	P/F	1.1	105.8	63

TABLE 2. HABITAT EFFECTIVENESS OF THE ANALYSIS AREA DURING THE HUNTING SEASON

Area (DU)	Acres	SQ. Mi	For	Cov	Ratio		Den	Length
Pre-1960's								
62204	97.2	32059	30145	52:48	F/P	.5	43.8	76
1960's Road Building/Timber Harvest/Oil Drilling								
62204	97.2	35405	26799	57:43	P/F	.9	88.4	65
1970's Road Building/Timber Harvest/Oil Drilling								
62204	97.2	36792	25412	59:41	P/F	1.1	105.8	63
Mid-1980's Prior to Sohare #1 (Current Situation)								
62204	97.2	37172	25032	60:40	P/F	.6	58.1	69

TABLE 3. HABITAT EFFECTIVENESS OF THE ANALYSIS AREA DURING SUMMER BY ROAD ALTERNATIVE (AFFECT OF HELICOPTER ACCESS IS EQUAL TO ROAD OPTION AFFECT)

Analysis Area (DU)	Total Acres	Total SQ. Mi	Acres For	Acres Cov	F/C Ratio	---Road--- Den	---Road--- Length	EHE
Alternative A (Kettle Creek)								
	62204	97.2	37172	25032	60:40	1.1	109.3	62
Alternative B								
	62204	97.2	37172	25032	60:40	1.1	109.8	62
Alternative C								
	62204	97.2	37172	25032	60:40	1.1	111.3	62

TABLE 4. HABITAT EFFECTIVENESS OF THE ANALYSIS AREA DURING THE HUNTING SEASON BY ALTERNATIVE (AFFECT OF HELICOPTER ACCESS IS EQUAL TO ROAD OPTION AFFECT)

Analysis Area (DU)	Total Acres	Total SQ. Mi	Acres For	Acres Cov	F/C Ratio	---Road--- Den	---Road--- Length	EHE
Alternative A (Kettle Creek)								
	62204	97.2	37172	25032	60:40	.7	66.9	68
Alternative B								
	62204	97.2	37172	25032	60:40	.7	70.2	68
	62204	97.2	37172	25032	60:40	.7	71.7	68

The cumulative analysis shows the primary effect on grizzly bears and their habitat to be the amount of open roads and the associated level of human use (ie. timber harvest, oil/gas exploration and recreational). The Sohare project would contribute to the longterm decrease in habitat effectiveness within the 62,204 acre analysis area if existing open road densities remained unchanged. During the life of this project grizzly bears may be exposed to human activity and would be displaced or, in some cases, attracted to areas of human inhabitation. If displaced, bears would move to sites that provide secure cover and forage sources away from man's presences. Adequate security habitat adjacent to the access road within the analysis area is not available, however, in the required amounts due to the extensive open road systems (open road density is greater than 1 mile per sq. mi.). Therefore, grizzly bears would be displaced into less desirable habitat. In the event the exploration results in a producing well, grizzly bears occupying this area will experience permanent displacement from their preferred habitat due to near constant use of access roads.

Under Alternative A, the analysis shows a downward trend. This is to be partially compensated for by additional road closures within the Spread Creek Drainage (Sohare Analysis Area - 62,204 acres). However the open road density within areas of occupied habitat still precludes meeting the recovery program objectives. To meet this objective would require an average open road density of 1.0 mile per square mile or less as described under the preferred Alternative of the proposed Forest Plan draft.

Studies have documented that the more contact grizzlies have with humans the greater likelihood that bear mortalities or human fatalities will occur. Roads are one of the primary means of increasing the probability of this interaction. Although the model used to evaluate cumulative effects does not consider a mortality risk factory, an increase in the mortality risk factor is expected.

This analysis assesses the existing potential for and the probability for changes in the potential for grizzly/human interactions. As expected, the analysis focuses primarily on the changes in roaded access into previously roaded and unroaded habitat, the change in the level of use on the roads and the ability of the grizzly to adjust to this change.

VII DETERMINATION OF EFFECTS

Possible effects of this proposal could come from disturbances related to this project or in combination with other existing and proposed projects. Unless cumulative effects of these projects are considered such effects could prove detrimental.

Based on the Analysis, in light of the current situation, we conclude that the proposed Sohare Unit No. 1-35 and Alternatives A and D-1 road access may effect the Grizzly Bear.

VIII RECOMMENDATIONS

The following recommendations are in addition to the proposed list of stipulations that the Forest Service recommends for inclusion in the Sohare Creek Unit proposal. These recommendations serve as compensative factors in an attempt to decrease the adverse affects associated with this proposal.

Whooping Crane

1. Prior to the implementation of road construction the Wyoming Game and Fish Department will check the area surrounding the proposed access route and well site to ensure that whooping cranes are not present in the area. If cranes are observed where they can be affected road construction will be delayed until after cranes have departed the area.

2. Helicopter flight corridors will not approach within 1 mile of any area occupied by a whooping crane.

Grizzly Bears

1. Information on location of radio collared bears, sightings or fresh signs within 1 mile of the access road or well site could cause suspension of operation until it has been documented that the bear(s) have moved away from the line. The company will be responsible for monitoring any radio collared bear identified within 5 miles of the proposed line to Forest Service specifications.

2. Road construction should be scheduled to minimize disturbance seasonally.

3. The main access roads should be single purpose and closed to public use from the existing road closure (Alternative A) or the end of the existing specified road (Alternative B). If Alternative A is chosen, a like amount of road impacted by truck traffic should be closed to all administrative and public use for the duration of the project. Likely candidates include Nation Creek and Grouse Mountain, areas that presently lack any transportation planning. For either Alternative A or B, existing gates on roads accessed from the South Fork of Spread Creek road should also be closed to vehicle use during the summer as well as the current practice of closing these roads in the fall. This is to ensure that adequate security areas are available adjacent to the area impacted by drilling or truck traffic. The longterm road transportation goal in Management Situation Areas 1 and 2 is to bring the density of open roads within individual Diversity Units to an average open road density of 1.0 mile of road per square mile or less. This is necessary to avoid a "may effect"

determination even without considering this proposal. This can be accomplished by the physical closure of existing roads or by use of gates. The surrounding Diversity Units or watersheds should have restriction on vehicle access when oil/gas exploration or timber harvest is ongoing.

4. If the well proves to be a nonproducer reclaim the drill pad and road access by planting preferred forage species.

5. Monitor long range District planning to ensure that no additional disturbing activities are planned during the period of the project that would contribute to an adverse impact on the bear. If it is determined that other disturbing activities must take place in any of the adjacent Diversity Units then a reanalysis will be done.

6. The proposed activity would not be initiated until after the mean denning date of November 15. All drilling would occur during the time that grizzly bears are in the den.

7. Off site camps should be encouraged. On-site camps can be made compatible with grizzly management objectives, however, if the following camp regulations are followed:

1. Food will be properly stored.

2. Garbage will be disposed of properly.

3 Firearms and dogs will be prohibited in the camp.

4. Camps will be located away from riparian areas and other known or suspected travel routes.

5. Crews will be bused to and from camp and drill sites to minimize activity.

IX SUMMARY

Since 1978 whooping cranes have been recorded in the Buffalo Valley. They are a result of the Grey's Lake reintroduction program which was initiated in 1974.

Grizzly bears have historically utilized the analysis area as spring, summer, and fall habitat and are known to have denned in the area.

Implementation of the Sohare drilling project is not expected to affect the whooping crane. However, the impacts associated with the proposed Sohare exploratory well and Alternative A and D-1 road access will result in a "may effect" situation for the grizzly bear. If the well is determined to by dry, the grizzly bears may be temporarily displaced from localized areas due to activities associated with the reclamation of access routes. Impacts associated with the drilling are not expected since the drilling will not occur until after the mean denning date (November 11) and will be completed prior to emergence from the den (April 1). If the well is found to be a producer, the impacts associated with continual vehicular traffic during the life of the project (20 to 30 years) is believed to result in the permanent displacement of grizzly bears from their preferred habitat. In addition, incrase in human activity associated with the management of the well and the removal of petroleum products will increase the mortality risk factor. Whooping cranes will not be subject to activities that will cause displacement or adversely affect the crane or it's habitat.

Based upon the assessment, the proposed project will not adversely affect the continued existence of the whooping crane but may adversely affect the continued existence of the grizzly bear. Therefore, a "may effect" decision is concluded.

X REFERENCES

Harms, Dale and Rob Hazelwood. January, 1986. Personal Communication, Endangered Species Program, USDA U.S. Fish and Wildlife Service., Helena, Montana.

Hoak, J.H. Jr., T.W. Clark. 1979. Status of Grizzly Bears in Bridger-Teton National Forest, Wyoming.

Lockman, D. January 1986. Personal Communication, Biologist, Wyoming Game and Fish Department., Smoot, Wyoming.

Murdock, M. 1985. Personal Communication, District Ranger, Buffalo Ranger District, Bridger-Teton National Forest, USDA, Forest Service.

Oakleaf, B. January 1986. Personal Communication, Nongame Biologist, Wyoming Game and Fish Department., Lander, Wyoming.

Roop, L. January 1986. Personal Communication, Wyoming Game and Fish Department., Cody, Wyoming.

USDA Forest Service. 1979. Guidelines for Management Involving Grizzly Bears in The Greater Yellowstone Area. Rocky Mountain Region, Denver.

1984. Endangered, Threatened, and Sensitive Plant and Animal species and their habitats on the Bridger-Teton National Forest, Wyoming.

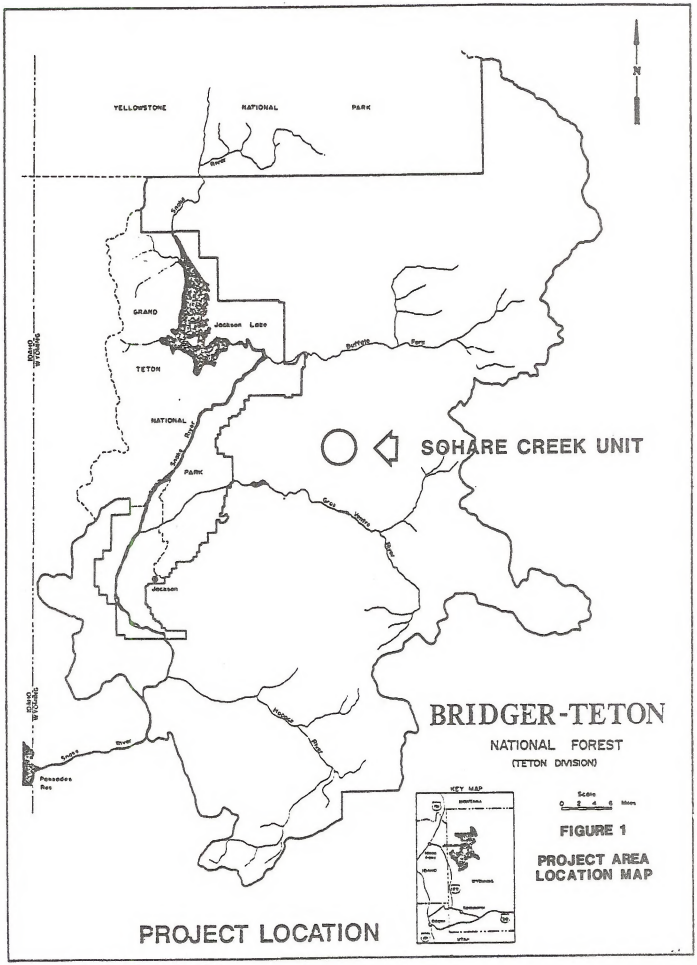
1987. Grizzly Bear Compendium, Interagency Grizzly Bear Committee.

XI APPENDIX

TIMBER PROGRAM IN OCCUPIED GRIZZLY HABITAT PROGRAM
1950-1986

ROADS	YEAR BUILT	TIMBER SALE	YEAR COMPLETED
HATCHET (SKULL CR. OIL WELL)	LATE 40'S		
286 (HIGHWAY)	MID 50'S		
FLAGSTAFF (2 MILES-EAST END)	1956	GAME CR. 1 (200 + AC)	1956
		SQUAW BASIN (60 AC.)	1958
HATCHET		HATCHET 1 AND 2	1963-64
FLAGSTAFF	1966		
HATCHET		EAST LEIDY (15 AC.)	1967
HATCHET		SKULL CR. MEADOWS (160 AC.)	1967
FLAGSTAFF		N. E. FLAGSTAFF (138 AC.)	1967-68
N.F. Spread Creen	1969-70	FLAGSTAFF	1969-70
(FORKS CLOSED MID 70'S)		FORKS	1969
(ROADS IN AREA CLOSED)		NATION CREEK	1970
N.F. SPREAD CREEK		N.F. SPREAD CR.	1970
N.F. SPREAD CREEK		GRIZZLY	1970-71
Moccasin Basin (CLOSED TO PUBLIC)	1971	MOCCASIN BASIN	1971
GROUSE, FORKS	LATE 60's	GROUSE CREEK	1971
HIDDEN LAKE, S.F. SPREAD CR.	1971	HIDDEN LAKE, S.F. SPREAD CR.	1972-73
GREEN MTN. (ROAD CLOSURES)		GREEN MTN.	
MOCCASIN BASIN		BEAUTY PK,.CALF CR. PAPOOSE	1973
		SKULL CR., WEBB RANCH	1973

HATCHET		BLACKROCK (300 AC.)	1975
N.F. SPREAD CREEK		BULL CREEK	1980
RED CR. COTTONWOOD CR.	1980	RED CR/ COTTONWOOD CR.	1980
SQUAW CREEK	1984	SQUAW CREEK	1985
		GRIZZLY-LEIDY	1985
		DRY LEIDY (WINTER)	1985-86


YELLOWSTONE
NATIONAL
PARK
Snake River
GRAND
TETON
NATIONAL
PARK
Jackson Lake
Buffalo Fork
SOHARE CREEK UNIT
Gros Ventre River
Jackson
Hoback River
Snake River
Palisades Res
WYOMING
IDAHO
N
BRIDGER-TETON
NATIONAL FOREST
(TETON DIVISION)
KEY MAP
Scale
0 2 4 6 Miles
FIGURE 1
PROJECT AREA
LOCATION MAP
PROJECT LOCATION

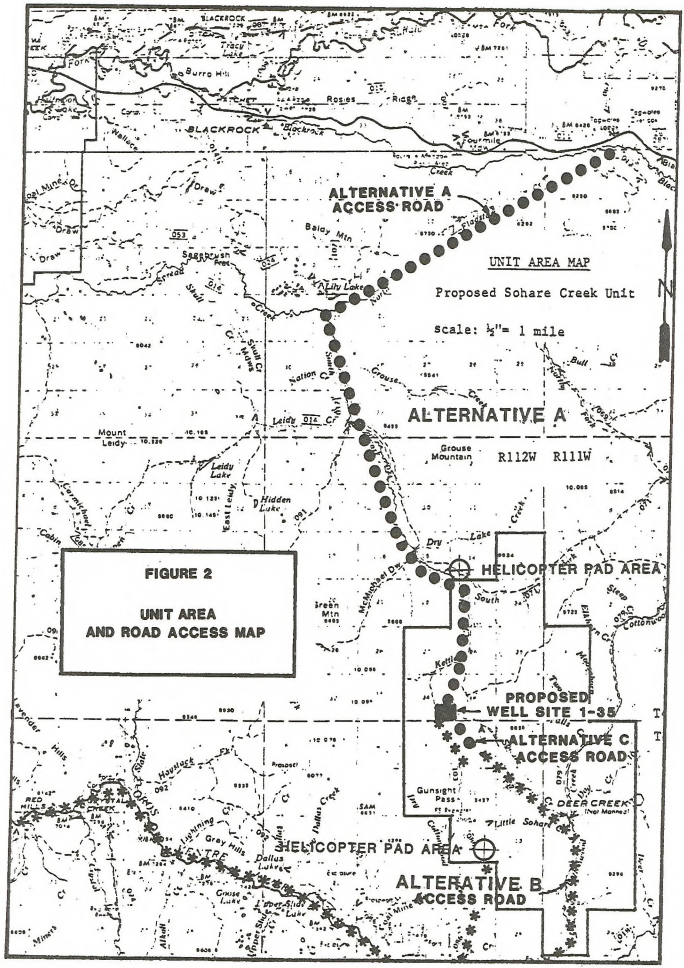
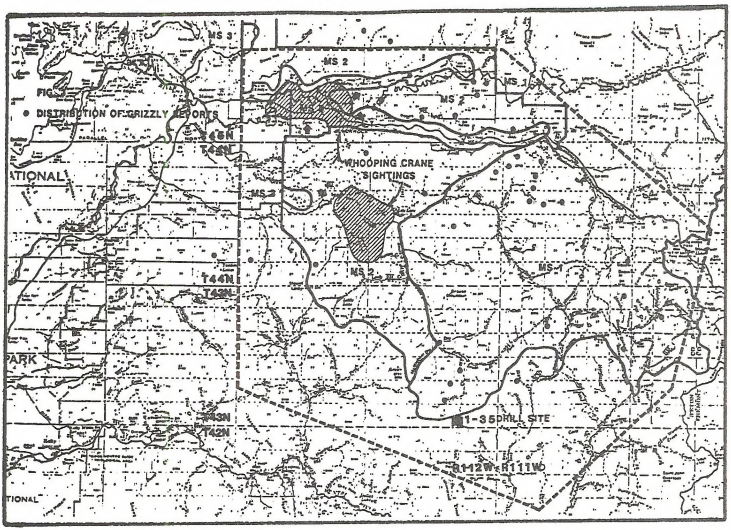


FIGURE 2

UNIT AREA AND ROAD ACCESS MAP



LEGEND

WHOOPING CRANE SIGHTINGS

DISTRIBUTION OF GRIZZLY REPORTS

FIGURE 3

GRIZZLY BEAR & WHOOPING CRANE DISTRIBUTION MAP

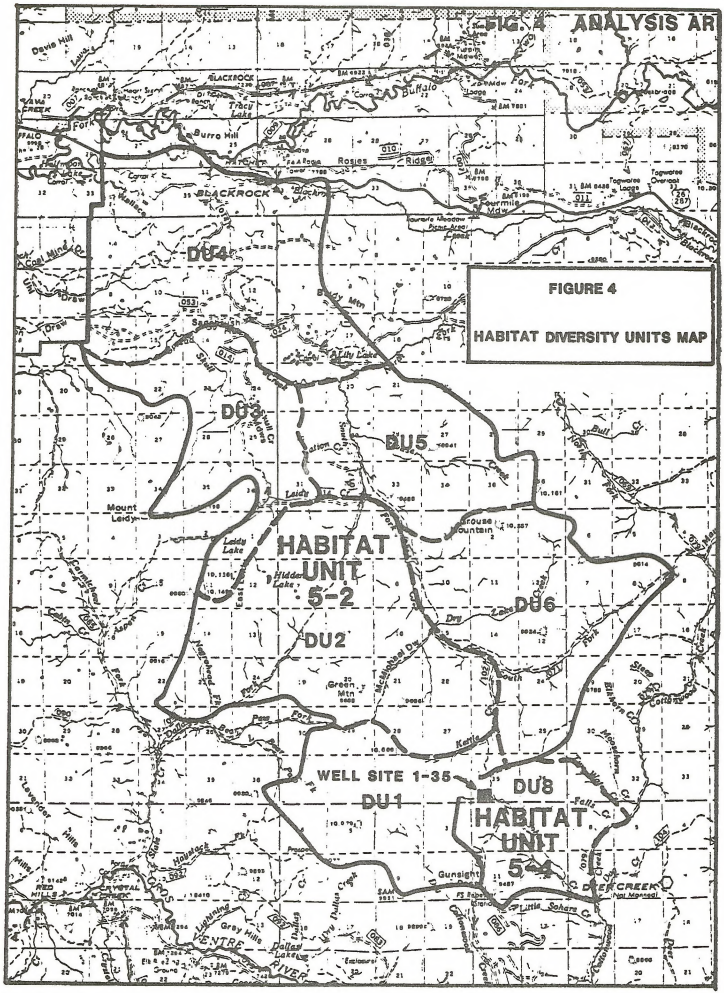


FIG. 4 ANALYSIS AR
DU4
DU3
DU5
DU2
DU6
DU1
DU8
HABITAT UNIT 5-2
HABITAT UNIT 5-4
WELL SITE 1-35
FIGURE 4
HABITAT DIVERSITY UNITS MAP
Mount Leidy
Leidy Lake
Hidden Lake
Grouse Mountain
Green Mtn.
Gunsight
Grey Hills
Dalton Lakes
Buffalo Fork
Burro Hill
Rosies Ridge
Blackrock
Coal Mine Rd.
Sagebrush
Lily Lake
Dry Lake
Dry Fork
Kelly
Jones Cr.
Deercreek
Little Sohare Cr.
Pine Grove
Lightning
Hillcrest
Red Hills
Pinedale
Mesa
Pavillion
Fremont Lake
Fremont
Boulder
Big Sandy
Big Sandy Creek
Big Sandy Reservoir
Big Sandy Campground
Big Sandy Lodge
Big Sandy Mtn.
Big Sandy Rec. Area
Big Sandy Rec. Area Boat Ramp
Big Sandy Rec. Area Campground
Big Sandy Rec. Area Lodge
Big Sandy Rec. Area Marina
Big Sandy Rec. Area Picnic Area
Big Sandy Rec. Area Visitor Center
Big Sandy Rec. Area Boat Ramp
Big Sandy Rec. Area Campground
Big Sandy Rec. Area Lodge
Big Sandy Rec. Area Marina
Big Sandy Rec. Area Picnic Area
Big Sandy Rec. Area Visitor Center

ADDENDUM TO

Biological Assessment of the Effect of Sohare Unit No. 1-35 Exploratory/Production Well and Road Access on the Whooping Crane and Grizzly Bear

Quantitative Analysis of Impacts on Seasonal Grizzly Bear Habitats Associated with Implementation of the Preferred Alternative A Access with Recommendations for Protection

Prepared by
Larry Hayden-Wing
Hayden-Wing Associates
Wildlife Consultants
and
Floyd A. Gordon
Wildlife Biologist
Bridger-Teton National Forest

July 20, 1987

TABLE OF CONTENTS

I BACKGROUND 1

II METHODS 2

III RESULTS 4

IV EVALUATION 5

V RECOMMENDATIONS 6

VI REFERENCES 7

VII APPENDIX 8

TABLES

1. Seasonal Values of Grizzly Bear Habitat in the Impact Area.

2. Seasonal Values of Grizzly Bear Habitat in the Mitigation Area.

FIGURES

1. Grizzly Bear and Whooping Crane Distribution Map.

ADDENDUM TO

Biological Assessment of the Effect
of Sohare Unit No. 1-35
Exploratory/Production Well and Road Access
on the Whooping Crane and Grizzly Bear

On June 18, 1987, a meeting was held at the U.S. Fish and Wildlife Service office in Helena, Montana between representatives of the Fish and Wildlife Service, Forest Service, BLM and project wildlife consultants to discuss the Sohare Creek Unit Exploratory Oil Well No. 1-35 draft Environmental Impact Statement (DEIS) and Biological Assessment (BA). A preferred alternative had not been presented for the DEIS nor identified within the original BA for this proposal. The Fish and Wildlife Service requested that a preferred access alternative be identified, that further analysis be conducted on the impact of this proposal on seasonal bear habitat use, and that specific measures to conserve and protect the grizzly be identified.

As a result of this meeting it was agreed that an Addendum to the BA would be prepared providing a quantitative analysis of impacts on seasonal grizzly bear habitats associated with implementation of the preferred alternative, Alternative A. Alternative A was selected because, based upon the Comparative Analysis of the Proposed Action and Alternatives (Chapter 5 of the DEIS), Alternative A would cause the least overall environmental impact. This Alternative proposes to access the well site from the north by way of Kettle Creek and the South Fork of Spread Creek Road. Based upon the results of this analysis and the habitat effectiveness evaluation contained in the BA, a final determination of the effect of the exploratory phase on the grizzly bear and its habitat is presented in this Addendum in Section IV, Evaluation.

I BACKGROUND

The cumulative effects analysis within the BA describes how the amount of open roads and associated levels of human use under Alternative A constitute the primary impact on the grizzly bear. As the amount of open roads and human activity increases, the effectiveness of habitat declines in the vicinity of the disturbing activity (Tables 1, 2, 3, and 4 of the BA). Since the northern road access (Alternative A) is the preferred alternative, the following additional analysis was made for the purpose of quantifying the magnitude and seasonal differences of impacts of Alternative A on grizzly bear habitat. When these values are known it allows the identification of currently roaded areas within grizzly bear habitat that would be of equal or

higher value to the bear if present levels of public and administrative use were eliminated. The closure of such areas would help to ensure that no net loss in bear habitat values occurs and would compensate for the impacts associated with the use of Alternative A.

II METHODS

A. Determining Existing Value of Grizzly Habitat to be Impacted.

The draft version of the Cumulative Effects Analysis Process for the Yellowstone Ecosystem was used as an overall guideline in developing a quantitative procedure for estimating impacts on grizzly bear habitats within the zone of influence of the Alternative A access road. This procedure consisted of the following steps:

1. Defining area of expected impact and average zone of influence.

The area of expected new impacts to grizzly bears along Spread Creek extends approximately 7.9 miles from the existing gate closure at the confluence of Leidy Creek and the South Fork of Spread Creek, southward along the proposed access to the southern extreme of MS-1 habitat just north of the proposed drilling site (Figure 1). All of this access lies within MS-1 habitat. The area within 1/2 mile of either side of this section of proposed access was determined to be the zone of influence which, according to the draft version of the Cumulative Effects Analysis Process for the Yellowstone Ecosystem is "the distance in which grizzlies would be affected by the activity". The 1/2-mile width was selected as the maximum average distance within which a ridgeline would occur or a line of sight vector would otherwise be interrupted by topographic features. This determination was based on interpretations of topographic maps and knowledge derived from on-site examination of the proposed access.

It was not automatically assumed that all bears would be displaced from a zone of influence. Instead it was recognized that grizzly bears would respond to different activities and levels of activities as described in the draft version of the Cumulative Effects Analysis Process for the Yellowstone Ecosystem. High levels of motorized activity behind the existing gate closure, as proposed under Alternative A, would mean that habitat effectiveness would decrease from current levels.

2. Quantification of grizzly bear habitat components within the zone of influence.

Grizzly bear habitat components within the zone of influence were identified, mapped, and quantified in acres. Habitat components were classified according to the criteria and systems described in: (1) Grizzly Bear Habitat Component Mapping Handbook for the Yellowstone Ecosystem, (2) The draft version of the Cumulative Effects Analysis Process for the Yellowstone Ecosystem, and (3) Forest Habitat Types of Eastern Idaho-Western Wyoming. Acreage determinations were based on a combination of planimetering and dot-grid measurements.

3. Determination of seasonal habitat values.

Seasonal values for the habitat types found within the zone of influence were extracted from the draft version of the Cumulative Effects Analysis Process for the Yellowstone Ecosystem and multiplied by the respective habitat acreages. The products were then summed to obtain a single weighted total for each season. The overall process for a given season can be formulated as:

$$\sum [(HA) * (HV)] = THV$$

Where: HA = the acreage of a given habitat type.

HV = the numerical value of the given habitat type.

THV = total habitat value for the given season.

B. Determining potential value of grizzly habitat recommended for protection.

1. Defining proposed protection area and average zone of influence.

The North Fork of Spread Creek was selected as a proposed protection area appearing to have the qualities that will ensure, after appropriate management measures such as road closures, that the bear has a quantity of secure habitat during each season. This habitat would be equal in value to that which is being impacted by the proposed Alternative A access road. This area is located adjacent to Forest Roads 30120 and 30140 where they parallel the North Fork of Spread Creek through Sections 15, 14, 13, 24, and 25 of T44N:R112W and Section 30 of T44N:R111W. The area extends from the junction of Forest Road 30120 with the Flagstaff Road (30100) in Section 10 (T44N:R112W) south and east along roads 30120 and 30140 to the point of the existing gate closure on road 30120 near the middle of Section 30 (T44N:R111W) (Figure 1).

The North Fork is currently open to the public and motor vehicles and is commonly used by campers, fishermen, hunters, an outfitter wagon-train operation, and general sightseers. The entire area within one-half mile of either side of roads 30120 and 30140, and the two major logging roads that extend north and east from 30140, was determined to be the zone of influence, or the distance in which grizzlies are affected by current human activities.

The 1/2-mile width was selected as the maximum average distance within which a ridgeline would occur or a line of sight vector would otherwise be interrupted by topographic features. This determination was based on interpretations of topographic maps and knowledge derived from on-site examination of the area. A result of implementing this action would be the replacement of the current high level of motorized use by nonmotorized activities. This would allow the full potential of the habitat values to be utilized by bears and would compensate for the increased activity proposed under Alternative A.

2. Quantification of grizzly bear habitat components within the zone of influence.

Procedures were identical to those described in preceding Section II A-2.

3. Determination of seasonal habitat values.

Procedures were identical to those described in preceding Section II A-3.

III RESULTS

The results of the habitat value calculations for the two areas are presented in Tables 1 and 2. The two areas are comparable in size and exhibit similar habitat values for bears in the spring. The two areas do differ in habitat effectiveness at the current time due to different road management practices as described earlier in the Addendum. The proposed protection area has moderately but consistently higher habitat values for each of the seasons with spring being 4.9% higher, summer 38.1% higher, and fall 39.6% higher. Much of these higher-valued summer and fall habitats is not currently usable because of the high level of motorized use that currently exists. The entire zone of influence in the proposed protection area lies within MS-1 habitat. The zone of influence in the expected area of impact is unequally divided between MS-1 (90%) and MS-2 (10%) habitat. The closing of roads within the North Fork will offset the loss of available habitat on the South Fork due to the higher value of the habitats to bears.

IV EVALUATION

A habitat effectiveness analysis is displayed for the preferred alternative in the BA. It indicated that the amount of open roads and associated levels of human use constitute the primary impact on the grizzly bear. A quantitative analysis of impacts on seasonal grizzly bear habitats associated with implementation of the preferred alternative is included in this Addendum. The grizzly bear cumulative effects model is not operational for the Bridger-Teton National Forest. However, it is possible to assess the potential effects against the variables and coefficients which drive the model.

A zone of influence, as described under the displacement submodel, was developed for the affected and proposed protected areas, and grizzly bear habitat components within the zones were identified. Approximately 5,071 acres of MS-1 and MS-2 grizzly bear habitat components within the South Fork of Spread Creek would be immediately effected upon implementation of the preferred alternative. The affected area is behind an existing road closure. To compensate, a 5,196 acre area of MS-1 habitat was selected within the North Fork of Spread Creek. This area is comparable in size, and exhibits similar habitat values for bears during spring. The North Fork has consistently higher quality values during the summer and fall than the South Fork. Much of the North Fork is currently open to motorized vehicles.

Within the zones of influence the displacement and mortality submodels are capable of differentiating between the current situation and the proposed actions. Associated with the current situation is low use linear motorized on the South Fork and high use linear motorized for the North Fork. Implementation of the preferred alternative would result in high use linear motorized on the South Fork and low use nonmotorized for the North Fork.

Based upon the above review, implementation of the exploratory drilling, or first incremental step of this project, has the potential to effect the grizzly bear through displacement and increased risk of mortality if conservation and protective measures are not provided. To provide for the conservation of the grizzly bear during this phase of the project, specific conservation measures (road management/habitat improvement) are described under Section V, Recommendations of this Addendum. They are in addition to those listed in Section VIII, Recommendations of the BA. The result of implementing these conservation measures is an increase in availability of habitats on the North Fork of Spread Creek that have a moderate but consistently higher habitat value than presently occur within the area affected by this proposal. Overall it is expected that more high quality habitat will be made available and displacement and mortality will be reduced as a result of implementing this proposal.

A determination of "may effect" was concluded in the April Sohare BA. As a result of informal consultation with the Fish and Wildlife Service, the Sohare proposal has been re-evaluated and better defined. Additional conservation measures were developed as a result of further analysis of this proposal on seasonal grizzly bear habitat use. Based upon the re-examination of the effect of this proposal it is concluded that the proposed actions is not likely to affect the grizzly bear. A "no effect" determination is concluded for the exploration phase of this project.

Development of a producing well and road access will require further consultation with the Fish and Wildlife Service and the completion of further environmental analysis and biological assessment to cover this phase of the project. These analyses will include assessments of alternative routes and methods for translocating products off the site. Each new phase or proposal will be dealt with as a new incremental step in the overall project and will require additional biological assessment and consultation with the Fish and Wildlife Service in accordance with the Endangered Species Act of 1973, as amended [50CFR Part. 402.14(k)]. The Forest Service will maintain an ongoing program to collect the data required for the analysis of subsequent phases and the final action for this proposed project.

V RECOMMENDATIONS

The following recommendations are in addition to those listed in Section VIII, Recommendations of the BA and the measures are outlined in Chapter 6, Mitigation and Monitoring, Sections 6.1.1, 6.1.2.2.8, 6.1.3.2.8, and 6.1.5.2.8 of the DEIS.

1. During the construction and drilling phase of the operation a gate closure should be erected on Forest Road 30120 North Fork Spread Creek as close to its intersection with the Flagstaff Road (30100) as topographic conditions dictate. No use of motorized vehicles by either the Forest Service or public should be allowed behind the gate.

2. To ensure progress towards grizzly bear recovery program objectives of reducing open road density levels to 1.0 mile per square mile or less, 4.2 miles of existing logging roads behind the gate closure proposed in #1 above should be disked and seeded during the construction phase of the operation.

3. If the well is a producer all of the remaining roads within the proposed mitigation area (approximately 12 linear miles) should be disked and seeded. In addition, the gate closure described in recommendation #1 above should be replaced with a permanent "tank-trap" closure that will exclude all motorized and wagon train traffic from the proposed protection area.

4. Gate closures should be erected on the Flagstaff Road near its confluence with U.S. Highways 26-287 and west of its confluence with the South Fork of Spread Creek Road. These closures should be appropriately signed and maintained throughout the life of the project exploration and production phases so as to exclude public use of the Flagstaff Road during the spring of the year (until June 15), when bears are emerging from dens and using riparian habitats.

VI REFERENCES

Mattson, D. J. 1985. Grizzly Bear Habitat Component Mapping Handbook for the Yellowstone Ecosystem. National Park Service and U.S. Forest Service.

Steele, R., S.V. Cooper, D.M. Ondov, D. W. Roberts, and R.D. Pfister. 1983. Forest Habitat Types of Eastern Idaho-Western Wyoming. U.S. Forest Service, Ogden.

U.S Forest Service. 1987. Cumulative Effects Analysis Process for the Yellowstone Ecosystem. Draft.

Table 1. Seasonal values of grizzly bear habitat within the zone of influence of the area of expected impact (Access Alternative A: South Fork Spread Creek and Kettle Creek).

Habitat Type[a]	Acres	Spring		Summer		Fall	
		Val	Ac x Val[b]	Val	Ac x Val[b]	Val	Ac x Val[b]
00012	10.15	0.476	4.83	0.322	3.27	0.556	5.64
00013	594.30	0.278	165.22	0.257	152.74	0.000	0.00
00014	1,048.55	0.000	0.00	0.144	150.99	0.000	0.00
00023	127.60	0.067	165.22	0.188	23.99	0.000	0.00
00033	29.00	0.000	0.00	0.241	6.99	0.469	13.60
00035	414.70	0.000	0.00	0.108	44.79	0.000	0.00
00041	11.60	0.000	0.00	0.279	3.24	0.000	0.00
72100	94.25	0.077	7.26	0.377	35.53	0.984	92.74
73200	1,713.90	0.013	22.28	0.325	557.02	0.528	904.94
73400	461.10	0.000	0.00	0.256	118.04	0.976	450.03
79100	21.75	0.062	1.35	0.101	2.20	0.208	4.52
Totals	5,070.65		209.49		1,115.66		1,659.06

a Habitat type according to Grizzly Bear Habitat Component Mapping Handbook for the Yellowstone Ecosystem and Forest Habitat Types of Eastern Idaho and Western Wyoming.

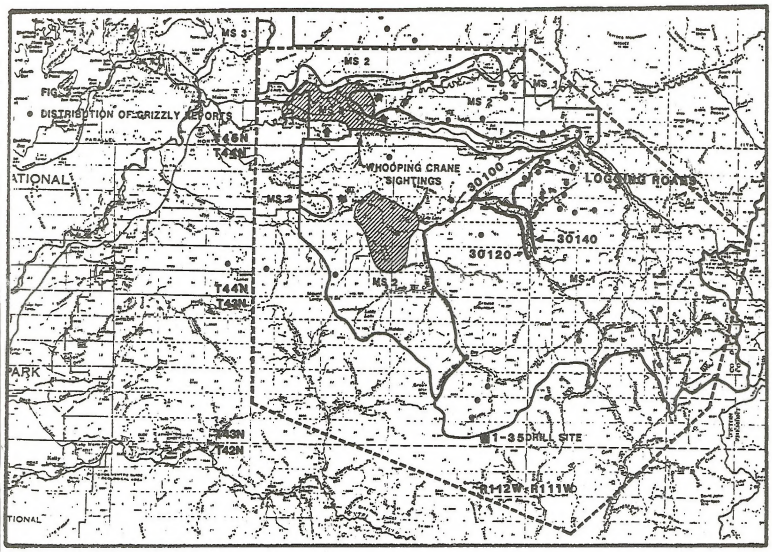
b Habitat value according to Cumulative Effects Analysis Process for the Yellowstone Ecosystem (Draft)

Table 2. Seasonal values of grizzly bear habitat within the zone of influence of the proposed mitigation area (North Fork Spread Creek).

Habitat Type[a]	Acres	Spring		Summer		Fall	
		Val	Ac x Val[b]	Val	Ac x Val[b]	Val	Ac x Val[b]
00012	194.45	0.476	92.56	0.322	62.61	0.556	108.11
00013	247.90	0.278	68.92	0.257	63.71	0.000	0.00
00014	258.15	0.000	0.00	0.144	37.17	0.000	0.00
00023	9.41	0.067	0.63	0.188	1.77	0.000	0.00
00032	20.17	0.000	0.00	0.126	2.54	0.000	0.00
00033	79.33	0.000	0.00	0.241	19.12	0.469	37.21
00035	52.44	0.000	0.00	0.108	5.66	0.000	0.00
41544	0.67	0.064	0.04	0.127	0.09	0.000	0.00
66331	5.38	0.050	0.27	0.194	1.04	0.418	2.25
66333	1.34	0.055	0.07	0.165	0.22	0.330	0.44
72144	99.50	0.077	7.66	0.346	34.43	0.864	85.97
73200	3,322.35	0.013	43.19	0.325	1,079.76	0.528	1,754.20
73230	769.08	0.006	4.61	0.245	188.42	0.334	256.87
73233	135.80	0.013	1.77	0.325	44.13	0.528	71.70
Totals	5,195.97		219.72		1,540.67		2,316.75

a Habitat type according to Grizzly Bear Habitat Component Mapping Handbook for the Yellowstone Ecosystem and Forest Habitat Types of Eastern Idaho and Western Wyoming.

b Habitat value according to Cumulative Effects Analysis Process for the Yellowstone Ecosystem (Draft)



LEGEND

WHOOPING CRANE SIGHTINGS

DISTRIBUTION OF GRIZZLY REPORTS

FIGURE 1

GRIZZLY BEAR & WHOOPING CRANE DISTRIBUTION MAP

PUBLIC HEARINGS REGISTRATION FORM

Please complete this form if you wish to make a statement at the public hearing on the Sohare Creek Unit Exploratory Oil Well No. 1-35 Draft Environmental Impact Statement.

(Please Print)

To: Alfred Reuter
Sohare Creek Project Leader
Bridger-Teton National Forest
P.O. Box 1888
Jackson, Wyoming 83001

From: Name_____

Street Address_____

City, State_____ Zip Code_____

Representing_____

I wish to appear at the Sohare Creek Unit Exploratory Oil Well DEIS public hearing on September 2, 1987, to express my views on the adequacy of the EIS.

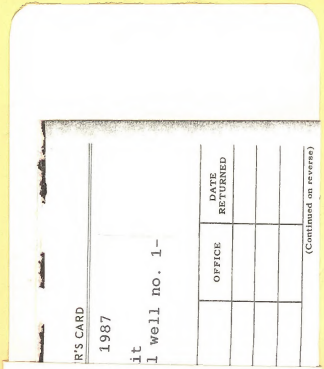
I intend to submit written documentation: Yes_____ No_____

_____
Signature

Verbal testimony will be limited to 10 minutes; written testimony and registration forms will be accepted at the above address until close of business on August 26, 1987. Registration will also be accepted at the door for this hearing.

☆ U.S. GOVERNMENT PRINTING OFFICE:1987-773-055/40072

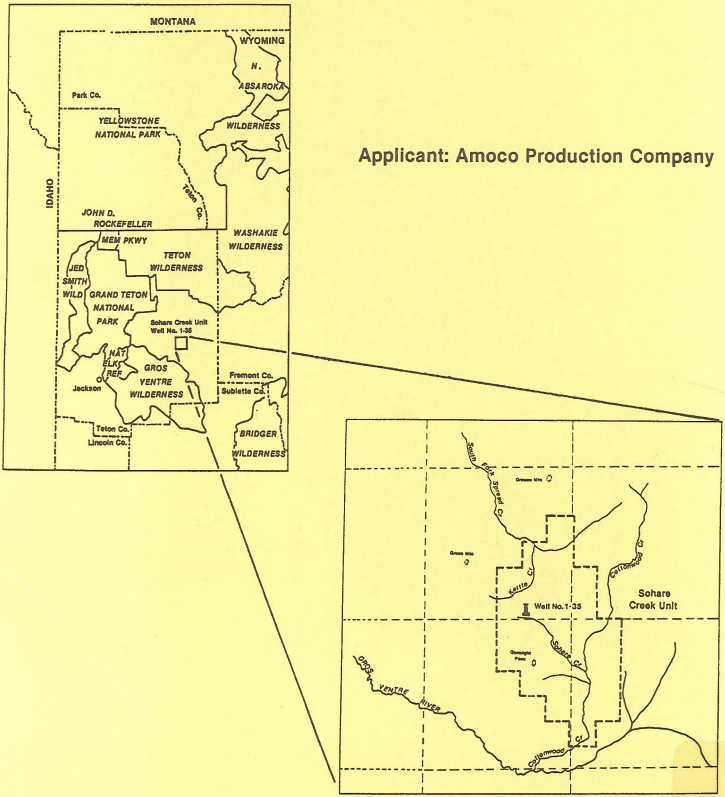
BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225



TD 195 .P4 S643 1987

Sohare Creek unit
exploratory oil well no. 1-

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225



Applicant: Amoco Production Company